APR - 9 1934

# Factory

## MANAGEMENT and MAINTENANCE

*April · 1934*

Couldn't Raise Prices—So?

Buying Circuit Breakers

Controlled Maintenance

Ninety in the Shade

Power, Make or Buy

Cold from Steam

Wagner Bill? *No*

New Leisure

McGRAW-HILL PUBLISHING COMPANY, INC.

A Standard Oil Engineer found these large paint and varnish manufacturers were using The WRONG STANDARD OIL!

HIS RECOMMENDATIONS

SAVED THEM 29.6%

HERE ARE THE FACTS:

One of the world's largest producers of lead, zinc and allied products—paint and varnish manufacturers of the Middle West—had been using *one grade* of oil rather universally. What they needed, for more economical lubrication, was oil more *specifically* suited to the job on each individual application. A Standard Oil Lubricating Engineer pointed this out, and recommended correct oils in each case. He also advised a change in the oil used on their refrigerating equipment. The saving from these suggestions amounted to 29.6% of the previous oil cost.

Often the key to such sizable savings waits in some simple suggestion like that. Sometimes the method of oil application is wasteful. Sometimes the type of oil is wrong. Almost always the savings that can be made are extremely worthwhile.

Standard Oil Lubrication Engineers recently saved a manufacturer of wood and fibre containers 50% of their lubrication costs — saved a mid-western gas company 54% — saved a mining company thousands of dollars over a three-year period — saved a large salt manufacturer 30% in lubrication cost, 50% in maintenance — saved one paper mill 50%, another 77% — saved a manufacturer of auto parts 73% of lubrication cost by reduction in maintenance . . . *Factual* savings.

Your own lubrication practices *may* be exactly correct — but the quick way to *be sure* you're not missing *possible* savings like these is to let us send you a Standard Oil Engineer — let him tell you. He can.

STANDARD OIL COMPANY SERVICE (INDIANA)

NRA

STANDARD OIL COMPANY
(INDIANA)

910 S. Michigan Ave. Chicago, Illinois

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A consolidation of *Factory and Industrial Management* and *Maintenance Engineering*

APRIL • 1934

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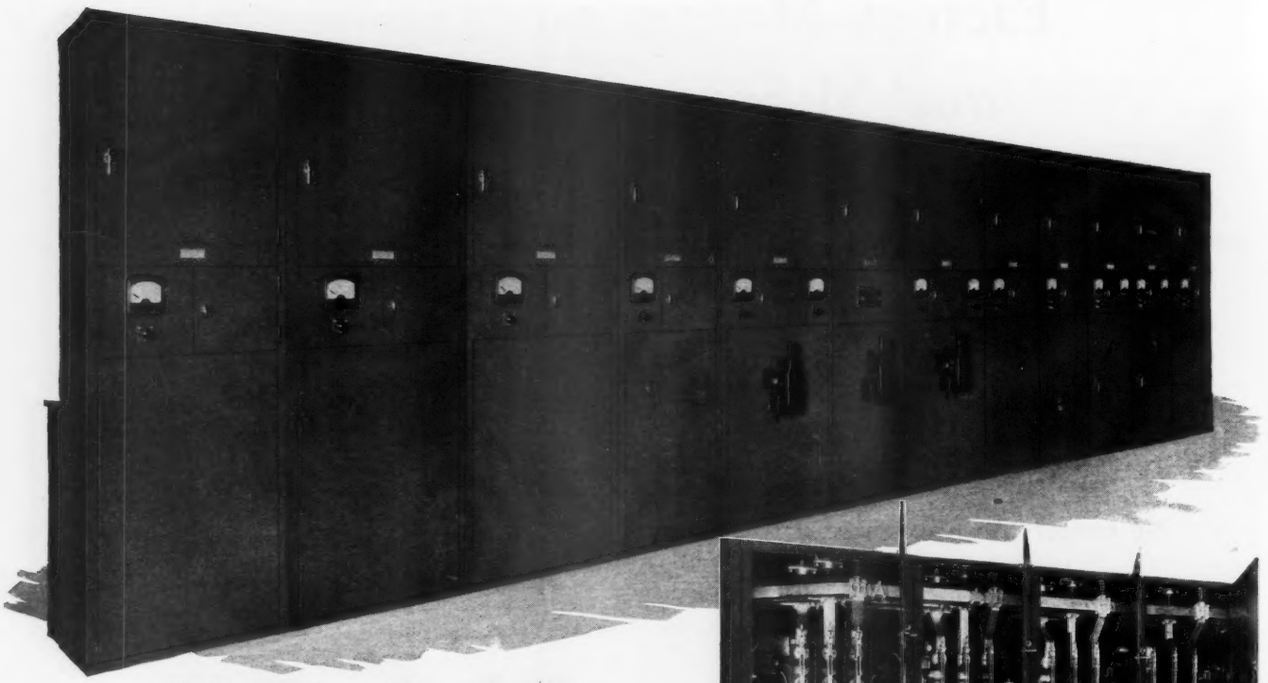
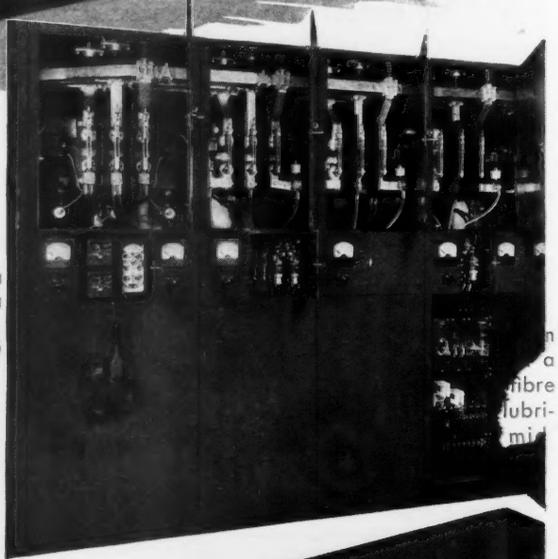


# EC & M

## DEAD-FRONT, UNIT-TYPE MOTOR CONTROL PANELS



TOTALLY ENCLOSED and complete in every respect, these EC&M Shock-proof Motor Control Units provide a safe, economical and extremely good looking job that is easily and quickly installed at low cost.

The 3550 HP, 2300 Volt equipment, illustrated, is for use in a large oil refinery now nearing completion. The complete assembly provides reduced voltage starting for 7 squirrel-cage motors and across-the-line starting for 2 synchronous motors with power supplied from two feeder panels and a power tie-in panel. Motor Starters are of the completely oil-immersed type and are mounted at the rear. Reduced voltage starters provide the *continuous torque method of acceleration* from the initial starting until motors have accelerated and are running at rated speed.

**WRITE FOR NEW ILLUSTRATED FOLDER,**
**giving complete specifications of this job and other EC&M Unit-type Starters**

The unit-type, completely-assembled construction has long been a feature of EC&M Motor Starters. This new folder describes how these starters can be combined with power panels and mounted in groups at a central point or, if desired and practical, they can be mounted separately as individual units out in the plant alongside the motors they control. Write for a copy.

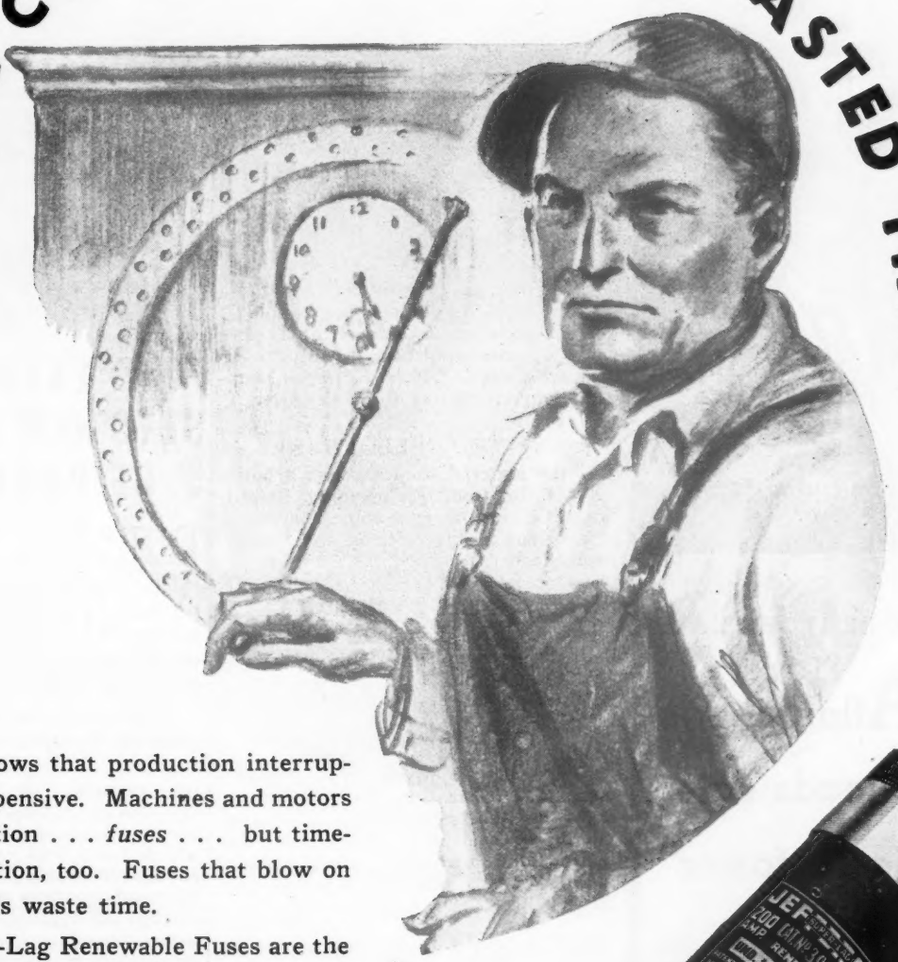
*Partial views showing close-ups of motor starters at rear and front panels*

## THE ELECTRIC CONTROLLER & MFG. CO.

**CLEVELAND, OHIO**

NEW YORK-50 CHURCH ST.
CHICAGO-310 So. MICHIGAN AVE.
DETROIT-DIME BANK BLDG.
BIRMINGHAM-BROWN-MARX BLDG.
CINCINNATI-1ST NATIONAL BANK BLDG.
ST. LOUIS-1027 CLAYTONIA TERRACE
HOUSTON-928 M.&M. BLDG.
TORONTO-#2 NEVILLE PARK BLVD.
PHILADELPHIA-WITHERSPOON BLDG.
PITTSBURGH-OLIVER BLDG.
SAN FRANCISCO-420 MARKET ST.
LOS ANGELES-912 E. THIRD ST.
BUFFALO-888 COLVIN BLVD.
SEATTLE-2207-1ST AVE. SO.

# NOTHING COSTS AS MUCH AS WASTED TIME



ANYBODY knows that production interruptions are expensive. Machines and motors must have protection . . . *fuses* . . . but time-costs need protection, too. Fuses that blow on harmless overloads waste time.

Jefferson Super-Lag Renewable Fuses are the perfect answer. They provide reliable *accurate* protection—ride over all harmless surges, operate positively on dangerous overloads. There is no better protection for your electrical equipment and property.

Your plant will show marked savings with Jefferson Super-Lags. Order them today. Made in all capacities—knife blade and ferrule types.

**JEFFERSON ELECTRIC COMPANY**
Bellwood (Suburb of Chicago), Illinois

# JEFFERSON Super-Lag RENEWABLE FUSES

The secret of Jefferson Super-Lag performance lies in the lag plate which is a part of the Super-Lag link. This plate delays the normal fuse action to provide a time interval or *lag*. This time-lag prevents the fuse from blowing on harmless temporary overloads—to save needless shut-downs and many link replacements.

CRANE OPERATORS SAY:

**"Atlas slings handle loads safer ... easier ... faster"**

● Macwhyte Atlas Braided Slings are quickly applied and hug the load, preventing slippage.

• Because they have a flexible non-kinking body made of multiple parts of wire rope, Atlas Slings are easier to handle and are unusually safe.

• Macwhyte Atlas (patented) Braided Slings are made exclusively by the makers of Macwhyte Wire Rope. Write for performance records, complete data and catalog.

Macwhyte Company • Kenosha, Wisconsin

ADV. NO. 129

MACWHYTE ATLAS *Slings*

# You want to know . . .

### INSULATING MATERIAL

Silica aerogel is fresh out of the laboratory. Said to be more efficient than any material now available as a heat insulator for refrigerators, electric ovens and furnaces.

### PEOPLE TRY—AND BUY

"See how easily you can cut these sticks" reads the tempting invitation on the box in which a Connecticut Yankee enables hardware dealers to display his pruning shears. There are more sticks inside for customers to practice on.

### KNITTED CELLOPHANE

Is the material used to wrap a bottle seen at the Fourth Packaging Exposition. Cellophane also comes shredded, in case you're interested in novel wrapping effects.

### BOTTLE CARRIERS

Simplify over-the-counter handling of bottled merchandise. Come flat. Are quickly made up. No tying, pasting, or wrapping. Convenient hand-grip.

### MILLING CUTTER

New general-purpose type provides more than a small part of the advantages on short-run, highly diversified milling of cast iron, non-ferrous, and non-metallic materials which special milling cutters offer on quantity production jobs.

### SAVE FREIGHT

Steel is heavy. You don't have to pay freight on scrap if you buy blanks or shapes instead of making them from dimension plate. And why pay dimension plate prices for what you don't use?

### STEEL STITCHER

Seals and reinforces tops and bottoms of corrugated cartons either before or after packing. Drives and clenches from one side. Produces stitching entirely blind on underside. Protects contents.

### TRANSPARENT ADHESIVES

Use of transparent cellulose in modern packaging has resulted in the development of transparent cellulose adhesives for wrapping, bag manufacture, window cartons.

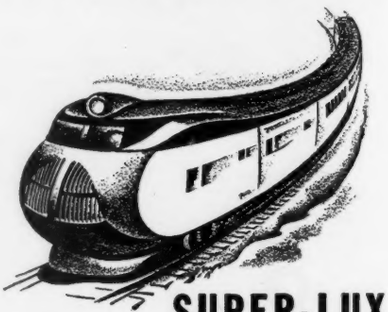
### DIE-CAST PACKAGES

Those metal belt boxes that can be used to hold cigarettes after you get the belt home are zinc die-castings.

### NOISELESS MOWER

First quiet lawnmower has no gears, is belt-driven. Cutting edges do not

**STREAMLINED TRAIN REVOLUTIONIZES TRANSPORTATION**



**SUPER-LUX FIRE EXTINGUISHER SETS NEW STANDARD OF PROTECTION**

BETTER construction has produced a faster train without sacrificing safety. Better construction has also produced a new LUX fire extinguisher having 33% greater extinguishing agent capacity with no increase in height or weight.

If you will test the new Super-LUX extinguisher, you will find the following true. 1. It puts out more fire in oil, gasoline, or lacquer than any other device of comparable size. 2. It smothers fires in running oil or gasoline against which foam and carbon tetrachloride extinguishers fail. 3. It puts out fires in electrical apparatus safely.

Tests will also show that the Super-LUX extinguisher does no damage, leaves no mess or moisture to clean up, will not freeze, and needs recharging only when used.

What better extinguisher is there to protect your plant from production delays and fire loss? Write to Walter Kidde & Company, Inc., Dept. SN-5, Bloomfield, N. J.

**Smothers Many Fires in Oil, Gasoline, or Lacquer Where Other Types of Extinguishers Fail**

**Safe for Electrical Fires**

**LUX CARBON DIOXIDE FIRE EXTINGUISHER**

# Noted for their ACCURACY, UNIFORMITY, BRIGHT SURFACE · · · AND BETTER MACHINING QUALITIES

VIGILANT Laboratory Control has established higher standards for the quality of cold finished steels. This rigid production safeguard is an assurance that Union Cold Drawn Steels will be uniform bar after bar. Their correct analysis, accuracy to size, straightness, smooth, bright surface and better machining qualities enable you to reduce manufacturing costs.

You will find a Union Drawn Distributor near you prepared to render a complete cold finished steel service. Take advantage of his large local stocks for quick delivery covering a wide range of sizes and shapes.

VIGILANT LABORATORY CONTROL

COLD DRAWING PROVIDES MAXIMUM MACHINABILITY

# UNION COLD DRAWN STEELS

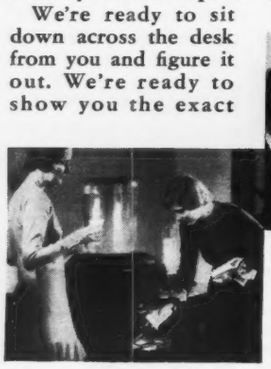
Fair enough, sir! We accept your challenge. And we're glad you take that attitude. For when a man is willing to be *shown,* it's an easy matter to convince him that Frigidaire Water Coolers *will* save him money.

Maybe you don't know how much you're spending right now to supply your employees with drinking water. And, in any case, we venture to say that you would be surprised if you knew how much you were spending *needlessly.*

We're ready to sit down across the desk from you and figure it out. We're ready to show you the exact savings you can expect from Frigidaire Water Coolers.

And remember, please, that we're talking about actual *money* savings. The increased efficiency resulting from water that is kept at healthful, invigorating temperatures—the savings in time and steps that are brought about by supplying water that really quenches thirst—the increased good will of employees... *these are extra dividends.*

May we send you complete information? The coupon below will bring you some interesting facts... and the proof about the savings you can make.



*Wherever there is a need for properly cooled water, there is Frigidaire Water Cooling Equipment to meet that need — engineered to meet the high standards set for all General Motors products.*

Frigidaire

WATER COOLING EQUIPMENT

Frigidaire Corporation, Subsidiary of General Motors Corporation, Dept. V-31, Dayton, Ohio.
Please send me complete information about Frigidaire Water Coolers.

*Name*.....

*Firm Name*.....*Address*.....

need to touch cutter bars to get results. Stampings instead of castings make it lighter, stronger.

### WOODEN WARE

Has come out of the kitchen. Now wooden dinner ware—soup and salad plates and such—is earning its way into the big home market.

### LAS-STIK

An Ohio manufacturer announces a wood putty made from real wood and a new synthetic resin which he says won't shrink or pull away from the surrounding wood. In colors, also in common wood finishes.

### SHEETS FROM ROLLS

If you use cellophane or other wrapping materials, they say you can save 15 or 20 per cent by buying rolls and cutting them up yourself into sheets. There is a "sheeter" that is about six weeks old built for just that purpose.

### TIPSY BOTTLES

Are definitely on the way out. Late convert to the tapering container with the broad base is a Cincinnati flavoring extract maker. New bottle is hard to knock over.

### CREOSOTES

The ordinary varieties burn the skin of workmen applying them. There is at least one, however, that won't.

### TELO-TIMER

Lights set around rim of a clock face warn telephoner of passage of time. Green light glows every 15 seconds. Yellow light over figure 11 shows 15 seconds to go before the 3 minutes are up.

### ONAZOTE

A vulcanized rubber product highly expanded by gas under pressure. Said to be lightest solid known, perfect insulator against noise, high in dielectric strength, vermin-proof, inexpensive. Is readily molded.

### THREE-IN-ONE

Even the prosaic kitchen pot lends itself to redesign. Latest cast aluminum saucepan is divided into three compartments. Saves space, saves fuel. Satin finish is good-looking.

### TUNING IN THE SUN

Newest instruments measure biologically effective ultra-violet radiation "by the cupful," both as to strength of rays and total content over a period of time. Should stimulate study and development of artificial ultra-violet sources.

### NEW NAME, NEW PACKAGE

Chicago sauce maker recognizes the fact that women buy the things on chain-store shelves that look good, scraps old name, old package, and gets himself a sales increase. New bottle has molded plastic cap.

### STAPLER

New edition of familiar gadget used to fasten papers together. This one doesn't have to be banged so hard. Can

# Thor RIGHT ANGLE .. attachments

The Thor 252N Rotary Right Angle nut setter for driving ¼" nuts

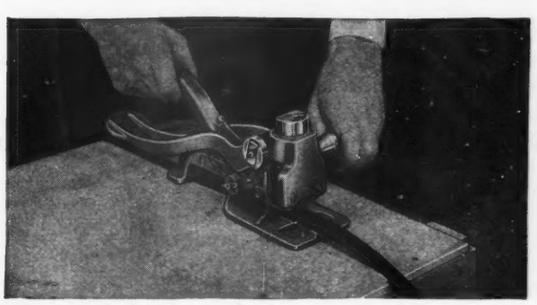
THOR engineers have developed so complete a line of screw and nut driving attachments that there has never been a production problem that has not been beaten.

**INDEPENDENT PNEUMATIC TOOL CO.**

New York — 600 W. Jackson Blvd., Chicago — San Francisco

Universal and High Frequency Electric Tools — Pneumatic Tools — Contractors' Tools

# Stanley Improved "3 in 1" Strapping Tool



**This latest model Stanley Tool combines in one unit the tightening, sealing and cutting operations, thus doing away with the now obsolete three-tool method.**

**Banding packages for safe transit and delivery has long since proven its tangible worth. We now offer a greatly improved tool that does the job *faster* and *better*, and at a *material saving* in cost.**

**This New "3 in 1" Tool is sturdily built, easy to operate and a great improvement over the original Stanley "3 in 1", which was the first combination strapping tool ever put on the market.**

**Your own INDIVIDUAL BRAND of Nailless Strapping, bearing your Company Name, Trademark or Slogan in BRILLIANT COLORS, coupled with this time saving equipment, make possible the very highest efficiency in package reinforcement.**

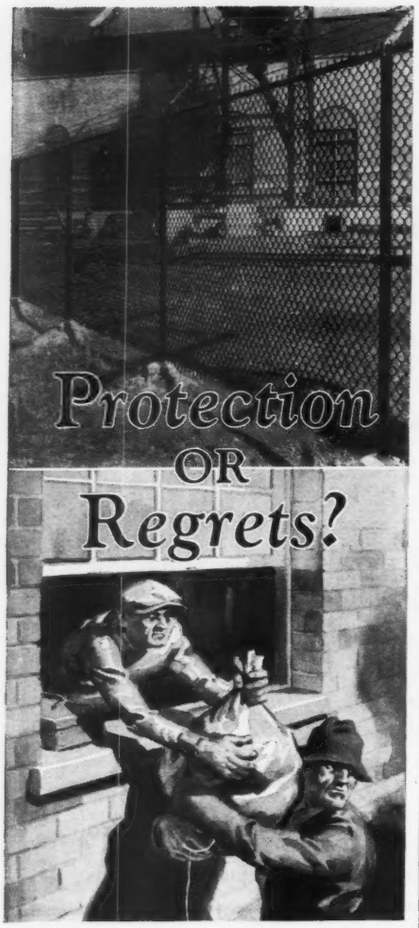
**THE STANLEY WORKS**

**New York** 100 Lafayette St. — **Box Strapping Division** New Britain, Conn. — **Chicago** 62 W. Kinzie St.

STANLEY EVERSAFE (Round Safety Edges) Japanned Nailless Strapping furnished in all standard widths and gauges.

DUPONT FOR BETTER PICTURES

Illustration of Colorgraph Strapping, which can be finished in any design and almost any color combination.




THE delay in the purchase of adequate protection for your property is not even a temporary economy. Such delay frequently entails, in just one day or night, trouble and expense far greater than the cost of Cyclone Fence. For the best fence costs very little when you consider that the cost spreads over so many years.

Thoughtless or malicious damage done to property, the inefficient restraint of outsiders, the lack of facilities in protecting against tool and stock losses from within, are all costly elements that can be eliminated by the installation of dependable Cyclone Fence.

This superior barrier, in spite of its low cost, provides a permanent safeguard, and saves many dollars in operating expense. It will pay you to become familiar with its many advantages. Today, write for complete information. Address Dept. FM.

**Cyclone Fence**
REG. U.S. PAT. OFF.

**Cyclone Fence Company**

*General Offices:* Waukegan, Illinois
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
BRANCHES IN PRINCIPAL CITIES

*Pacific Coast Division:*
Standard Fence Company
Oakland, Cal.

*Cyclone—not a "type" of fence, but fence made exclusively by Cyclone Fence Company and identified by this trade-mark.*

be converted to a tacker by swinging back the base, then used to tack paper to drawing boards, to post bulletins, etc. Also, a new pocket fastener. Fits hand, desk drawer, brief case.

### DRAM SHOP

A Portland (Ore.) department store capitalizes on the return of the bar to approximate respectability, sells perfume over the bar, mostly in dram sizes, has trebled sales.

### BEER BUSINESS

The brewers aren't the only ones who welcomed beer's return. A single recent order for beer signs involved 50 miles of luminous tubing, 91,000 square feet of sheet steel, 41,000 electrodes, 5,800 transformers, 7 miles of cable, and 300,000 man-hours of direct labor.

### FLY PAPER

Not the sticky kind, but a fine paper product watermarked by the tiny wings and legs of the European housefly. Expected to be shown for first time at A Century of Progress next summer.

### GROWING INDUSTRY

Manufacturers in automatic heating and air conditioning field will be glad to know the natural gas industry has over 7,000,000 customers.

### PROFITGUIDE

A 12-page folder helps you ask yourself stimulating questions about your customer, your product, your selling, your plant.

### STREAMLINED FAN

People are "streamline-conscious." So a black and silver electric fan streamlined like a sea gull in full flight.

## On the Calendar

**APRIL**

**19,** National Safety Council, Inc., Eleventh Annual Safety Engineering Conference, Pittsburgh, Pa. W. H. Cameron, Managing Director, 20 N. Wacker Drive, Chicago.

**25-26,** National Metal Trades Association, annual convention, New York. J. E. Nyhan, National Secretary, Peoples Gas Building, Chicago.

**MAY**

**14-17,** National Fire Protection Association, annual meeting, Atlantic City, N. J. Franklin H. Wentworth, Managing Director, 60 Batterymarch St., Boston, Mass.

**JUNE**

**17-22,** Society of Automotive Engineers, summer meeting, Saranac Inn, N. Y. John A. C. Warner, General Manager, 29 West 39th St., New York.

**18-21,** National Association of Purchasing Agents, annual convention and Inform-A-Show, Cleveland. Ralph G. Sweeney, General Convention Committee Chairman, Allyne-Ryan Foundry Co., Aetna Rd., & E. 91st St., Cleveland.

**18-23,** American Association for the Advancement of Science, summer meeting, Berkeley, Calif. Henry B. Ward, Permanent Secretary, Smithsonian Institution Bldg., Washington, D. C.

**25-29,** American Society for Testing Materials, annual meeting, Atlantic City, N. J. R. E. Hess, Assistant Secretary, 1315 Spruce St., Philadelphia, Pa.

**25-28,** National Association of Cost Accountants, annual convention, Cleveland. Stuart C. McLeod, Secretary, 1790 Broadway, New York.

OLD

THE old gives way to the new! Gone is the day of soda and acid fire extinguishers that must be recharged every year! Gone too, is the yearly expense of keeping them in operating condition!

The new Kidde extinguisher, labeled by the Underwriters' Laboratories and the Factory Mutual Laboratories, does not require annual refilling. It is good until used . . . it contains no acid or damaging chemicals . . . it has all the effectiveness of soda and acid extinguishers . . . yet it costs no more.

Before you buy extinguishers, be sure to investigate the new Kidde unit. It gives better protection than soda and acid extinguishers at no higher initial price. And it saves up to a dollar a year, as well as untold trouble, in maintenance. Write to Walter Kidde & Company, Inc., West Street, Bloomfield, N.J., for descriptive literature.

NEW

KIDDE PURE WATER
FIRE EXTINGUISHER

*FACTORY MANAGEMENT and MAINTENANCE*

APRIL, 1934

# *They Couldn't Raise Prices So They Went After Costs*

*Lewis K. Urquhart*
*Associate Editor*

TWO WAYS of dealing with rising costs, once so popular with the manufacturing gentry, have been quite definitely outmoded. One is the pleasant pastime of passing part, preferably all, of the increase on to the consumer. The other is the equally playful practice of cutting wages. In either case, the idea is to make the consumer and the worker like it. The trouble today is, for reasons we need not go into here, they have both stopped liking it. Raise prices and the consumer won't buy; cut wages and the worker can't.

In a way the joke has always been on the manufacturer, even in the good old days when the "system" worked, for there he was fiddling around with wages, perhaps courting trouble and creating dissension, when right under his nose were other ways, plenty of them, of realizing savings of infinitely greater importance.

For instance, a shoe manufacturer makes 5,700 pairs a day, in two plants. It takes 6½ days, after shoes have been cut and stitched, to get them lasted, bottomed, and packed. What would it not do to unit costs if that manufacturer could concentrate production in one plant, if he could step it up to 6,000 pairs, if he could halve that making time?

Is 20 per cent a bad guess? Let's see. Two years ago the G. Edwin Smith Shoe Company, of Columbus, Ohio, operating 68 retail stores in the Nisley chain, was making those 5,700 pairs a day. A year ago last summer this concern conveyorized one of its two plants—with the following results:

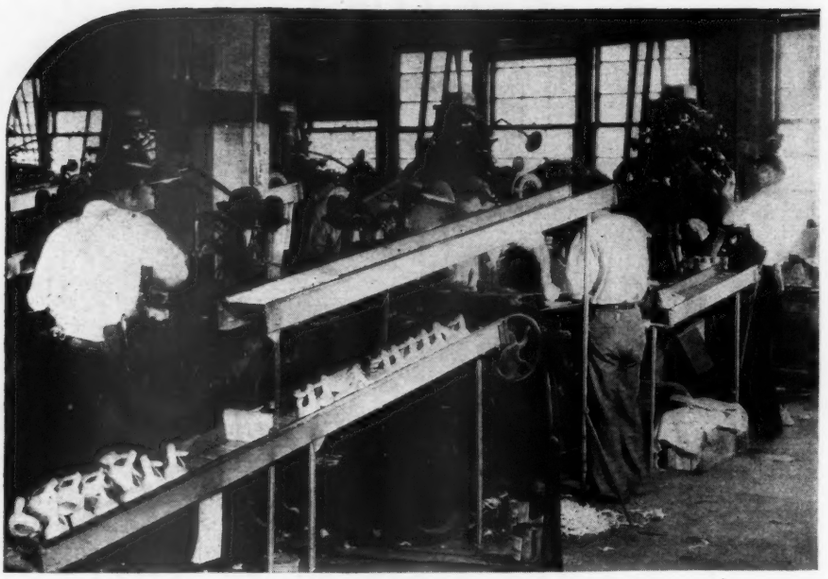
1. Unit costs are 15 to 20 per cent lower—and nothing has happened to wage rates. Time studies on an edge-setting and edge-trimming unit, for instance, show a saving of 16 per cent.

2. Hourly production is up from around 500 pairs to better than 650—all without adding extra floor space. In fact, they now have more idle space than when operating at 500 pairs — could bring making rooms up to 900 pairs an hour with little additional capital expenditure, hence are in a strategic position to handle more business when it comes.

3. The Newark, Ohio, plant has been closed—and yet they are making more shoes in the Columbus plant than were formerly made in both factories. Savings are obvious.

4. In August, 1932, B.C. (before conveyor), running time from fitting room to carton was 6½ days. A

**Handling at the G. Edwin Smith Shoe Company has now been made a part of processing; operators spend all their time operating; public gets better shoes for less money**



**Short sections of gravity roller conveyor tie individual lasting operations into compact, efficient production units. Skilled workers waste no time pushing racks of shoes around. Unskilled members of each group do what walking has to be done**

year later, after the conveyor had been installed, this time was cut to 3½ days.

5. Decreased running time has lowered number of pairs in process by 18,000—a sizable saving in inventories. Also, last purchases have been cut in half—and lasts cost a couple of dollars a pair.

6. Retail stores get quicker deliveries, can now operate with smaller stocks. It is also possible to develop a new style in the middle of the selling season and get it to the stores before the style has begun to wane.

Impressive results, these. Even if they were not, the story would be worth telling, for the shoe concern that conveyorizes is breaking all the rules and regulations of shoemaking. Like many another industry, shoemaking has its traditions, guards them jealously.

Not the least of these traditions, apparently, is that shoes after leaving the fitting room must be moved on racks. Not so many years ago, racks held 30, 36, even 60, pairs of shoes. Today the 12-pair rack has become fairly standard equipment, is naturally a big improvement. The smaller lots move more rapidly from machine to machine. Production flow is correspondingly regularized, even speeded up.

There's a catch, though. Even with the 12-pair rack, someone has to move them about, and that someone is the operator. In other words, the man who is paid for certain skill he possesses, has to spend part of his time wheeling racks out of the production line and moving them back again when his work is done. How serious this may be is illustrated by actual experience; time studies taken of a side laster's work showed he was spending one hour out of nine pushing racks around.

Essentially, therefore, our story is the old familiar one of bringing the work to the operator and taking it away again, leaving him something more nearly approaching full time for the "do" part of his job. The plan is to give the side laster a chance to spend all nine of his hours side lasting—and so with every other operator—leaving the job of handling either to the machine, to someone who part of the time has nothing better to do, or to the lowest paid member of a given group.

The trick, if any, has been to tie the handling system so closely into the process that it becomes an integral part of the manufacturing job—which is exactly what has been done. Here are not the "miles" of conveyors which so often seem to exist for the sole purpose of carrying the product all over the lot, or so that important company executives will have something nice to point at when they show their friends around. Here is a longish belt conveyor or two, there a fair-to-middling slat conveyor, but for the most part the conveyors used in this plant are short sections of the gravity roller type that look as though they never would amount to much and are in fact little more than chutes used to connect one machine to the next. The rolls are necessary, though. Shoes do not improve with chuting; they must slide on their bottoms from place to place.

To get the process picture into which handling has been so closely tied, we must go back some four years. At that time a group of young men, with utter disregard for what had always been considered some of the finer things in shoemaking, were trying to convince manufacturers that cementing was the sensible and modern way to attach outer soles to shoes. The Smiths have always been willing to be "shown," so it is quite natural to find them among the first to try out this new "Compo" process. How good their judgment was, is perhaps best illustrated in the fact that 30,000,000 pairs of Compo shoes—about one-fourth of all the women's shoes—were made in this country last year.

### A New Way to Make Shoes

In January, 1930, however, the process had barely passed the experimental stage. The Smiths installed their first equipment, tried out the shoes in their retail stores, made sure the bugs were all out, gradually changed over so that today cemented shoes have completely replaced the McKays which formerly made up the bulk of their production.

To appreciate the advantages of cementing, the Compo process may be compared with the McKay process which it has replaced:

1. The cemented shoe goes through dry, which saves

time, minimizes the danger of damage in making. The McKay is wet at least twice—sometimes three times—to temper stock, to make stitching through the sole possible, to facilitate leveling or beating out the sole.

2. The Compo shoe hugs the last, is vastly better looking. The McKay is distorted in the stitching process, invariably throws a wrinkle in the upper at the shank. Linings, too, are apt to be wrinkled.

3. McKays—the better ones, at least—require two sets of lasts. The original is pulled so that the outsole may be stitched to the inside. A follower must then be inserted and kept in during the remainder of the bottoming process. The stitches make the sole heavy and inflexible. It is next to impossible to beat them out so that the insole is absolutely smooth. The Compo insole has no stitches.

4. A McKay outer sole must be channeled to hide the stitching. The channel lip is apt to lift away from the sole and leave the stitches exposed.

5. In lasting McKays, the tacks are driven in for keeps. In Compo shoes the tacks stay in only while the cement is drying; the only tacks that stay in permanently are around the heel seat.

6. In stockfitting, Compo shoes have no particular advantage so far as number of operations is concerned. McKay soles must be wet, however, and alternate wetting and drying never did leather any particular good.

7. The Compo process saves space. One Compo unit will turn out 1,500 pairs a day—as much as five rinks of McKay lasters.

In short, Compo shoes are light and flexible without sacrificing wearing quality. The shoe retains its shape and style lines as long as it is worn. And the percentage of shoes returned because of faults in construction has been smaller than ever before.

### Planned Production

Now to follow shoes through the factory and see the actual working of the conveyor system and its close tie-up with processing.

In the first place, shoes go through in blocks of 1,200 pairs, five blocks constituting a day's work at the present time. Each block is carefully balanced as to: (1) Cutting room patterns; (2) Fitting conditions; (3) Turnover of lasts.

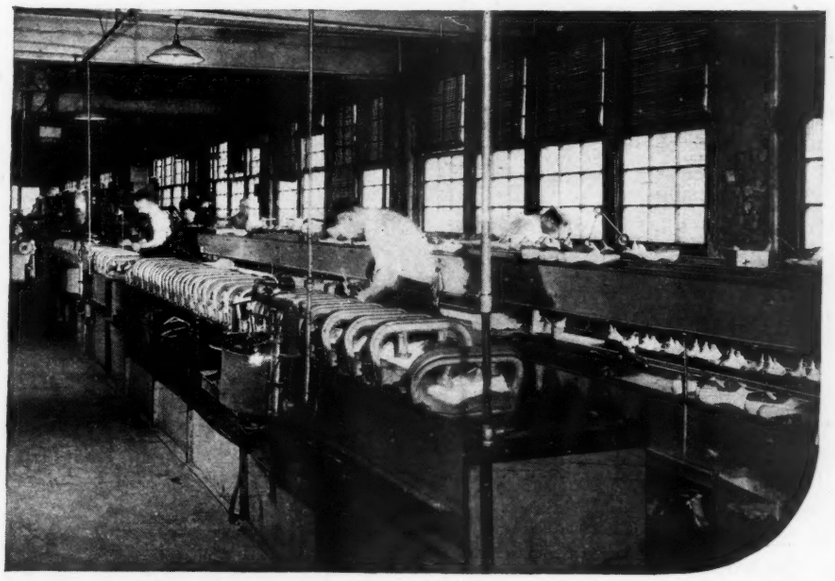
First, the cutting room. Clicking machines have been used for the past year and a half, and saved $24,000 the first year after paying for the dies. The management either had to put in machines and get out more work with the same weekly payroll or else take on 20 more cutters and pay them all less money. A little job of selling was done, and it is doubtful if any cutter today would care to go back to the old way—certainly not if it meant less money.

So there are 61 cutting machines. Since they are rented (as is the practice with most shoe machinery) no investment in new machines was necessary, but the investment in dies is large because they must be bought in three widths and in sizes 2½ to 10. The practice is to make one die width serve two widths of shoes—that is, by cutting up or down half a size.

It is further customary to work three men to a width. Hence nine men can work on any given pattern, and knowing how many shoes nine men can turn out, it becomes a relatively simple matter to balance each block so that it will go through the cutting room on schedule. About five patterns to a block ordinarily give the proper balance.

Balancing the block for fitting room conditions is somewhat more difficult. This week the problem may be single-needle (fancy) stitching, next week vamp stitching, another week French cording, and so on. It all depends on the styles that are going through.

Take single-needle stitching, for instance. One pattern may run 45 cents a hundred pairs; another may cost only 15 cents. Obviously 45 cents' work of stitching is three times as much work as 15 cents' worth. A girl working on the former, therefore, can turn out only one-third as many pairs, so for each block the amount of single-needle stitching is figured, not in pairs—which would mean nothing—but in actual dollars. Then, knowing through time studies made on every new pattern what each girl is able to earn, it is easy to figure out



**A double-decked belt conveyor serves two cementing units, takes the walking and handling out of the job. This successful combination of new process and new handling, backed up by competent production planning, has shortened making time by three big working days**

**Again conveyors — moving slat conveyors this time— leave workers free to use the skills for which they were hired. Here shoes move through the various bottom-finishing operations. The old way was to push shoes on racks from one operation to another. Each man did his own pushing**

how much single-needle stitching a block will stand. Also, the foreman can tell by glancing at the blocks ahead of him just how many girls will be needed any given day for any given block.

Exactly similar procedure is followed in balancing the block for French binding, folding, top stitching, and hole stitching.

### No Tendency to Jam

It should be explained that there are no conveyors as yet. Work goes through the fitting room on small double-decked floor trucks or tables. Each has eight compartments. For fast-moving shoes like pumps which do not have much fitting there will be eight 12-pair lots to a table. If the shoes require a good deal of fitting, plenty of fancy stitching, and so on, only four lots will be used to a table—the idea being to have all the shoes in a given block reach the delivery end of the room at about the same time. Ordinarily, the shoes will move out of the room, just as they entered, in a 1,200-pair block.

It is important to note, then, that this fitting room is scheduled, not on so many pairs, but on so many dollars and cents of labor. In that way there is not the tendency to jam which is quite the customary thing in shoe factories.

The next care of the production planner is to balance for lasts. This can be tremendously difficult, may be quite impossible, in some plants, it being quite hopeless to attempt to figure exactly what sizes and widths and how many pairs of each will be available a week or ten days after the shoes are sheeted and sent to the cutting room. The reason for this state of affairs, of course, is that shoes stay on the lasts several days and it becomes extremely difficult to forecast exactly *which* ones will come off the wood *when*. The usual practice, therefore, is to buy more lasts than would otherwise be needed, or else run the danger of having cut and fitted shoes sitting around waiting for lasts, with consequent disruptions to production and deliveries.

The plan here is simple. Since the adoption of the cementing process and the installation of the conveyor plan of moving shoes, the latter stay on the wood one day and no more. There is a complete turnover of lasts, then, every single day, attributable in large measure, of course, to the use of mechanical driers which, in a day and a night, do a better and quicker job of drying shoes on the lasts than was possible when they were merely allowed to remain on racks in the open air. Balancing the block to take care of the last situation becomes, in consequence, child's play. Knowing that you have, say, 4,000 pairs of lasts of a given style, and knowing exactly how many pairs you own on each size and width, what could be simpler? It is only necessary to list the sizes of each style of shoe in a given block and make certain that you own lasts to make them on.

So much for the planning and balancing of the work. It now becomes necessary to follow the shoes through the making room and to describe their progress in some detail in order that we may see how the conveyor system has been built right into the actual lasting and bottoming operations.

First, the uppers have gone into a muller so that they may absorb just enough moisture to make them pliable. One important result of this treatment is to soften the starch in the linings, making them easier to work with. Then, as the linings dry on the last, they regain much of their original crispness.

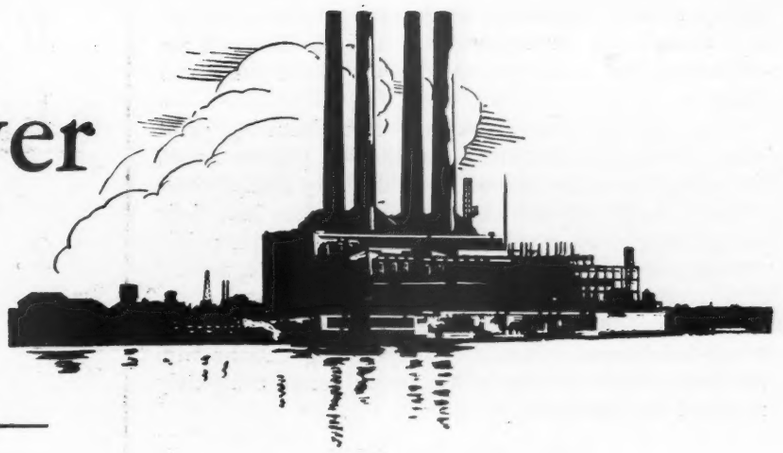
There are eleven lasting teams on Compo shoes in the Smith plant. Each team consists of (a) an assembler. (b) a puller, (c) two side lasters, (d) two bed machine operators.

### How Conveyors Help

The assembler's job is the simplest, as he does the handling. First he gets the uppers out of the muller and moves the rack with lasts, innersoles, and counters to the lasting unit. Then (a) the assembler tacks upper and counter to the last with a single tack at the back seam; (b) the puller pulls over the uppers on his machine and tacks them in place, puts the left shoe on a short section of gravity roller conveyor to go to one of the side lasters, and passes the right shoe across the table to the other side laster; (c) the side lasters last the sides and pass the rights and lefts, as the case may

*(Continued on advertising page 40)*

# Your Power



## When to Buy It—
## When to Make It

*David Moffat Myers*
*Consulting Engineer, New York*

***The wrong way may cost you an extra 30 per cent***

MOST MORTALS become hot and bothered over certain subjects. They get temperamental. They take sides. They see red. They divide into camps of standpatters who just can't see more than one side of a question. They spend their valiant efforts in building up defense mechanisms to support their preconceived hypotheses until they have no energy or incentive left for an unbiased search for truth.

One good fellow who used to cruise with me, but who knew nothing of navigation, would nevertheless dispute the accuracy of the course. When I suggested that he take a look at the chart he would refuse to do so on the score that he preferred to argue.

Religion, politics, and power are among the subjects which so often completely disorganize the thinking and judgment of the human mind. In religion a man will stoutly defend his belief on the ground of his father's and grandfather's conviction. In politics a voter will support a candidate who has caused him to pay unnecessary taxes just because he happens to be a personal friend of the family.

In the power field, a vice-president of a large industry buys all the power for his factory because he plays golf with the president of the local power company, who is a mighty fine fellow. Another captain of industry makes all his own power because he entertains a fine dislike for public service companies and all their works.

Power problems handled in this way can result only in increased expense and reduced dividends for the industrial consumer.

Substantial yearly sums can be conserved in industry if plant owners will adopt a certain simple policy in regard to power and then follow through. Here is this simple policy: *Buy power where it should be bought; make it where it should be made.* In some cases it is much cheaper to buy it, and in others it is much cheaper to make it.

Nevertheless, this common-sense policy has not been followed in hundreds of plants. Many plant owners are making power in a wasteful and costly manner when they should be buying it; many others are buying energy when, owing to conditions within their plants, they should be generating it at much lower cost.

There is still another class of plant conditions where the minimum operating cost would be secured by certain methods of combining purchased and generated energy, but this practice also is not followed in many cases where it should be.

A harvest of economies consequently awaits the complete adoption by industry of that simple policy of buying power where it should be bought and making it where it should be made.

### No Standardized Solution

The correct and economical disposition of the power problem involves highly technical and specialized knowledge. Except in the largest plants there is not available the particular kind of special knowledge essential to a correct solution of the power and heating problem. The net difference between the right solution and one of the many wrong "solutions" will often run up to 30 per cent of the former power cost.

There is no standardized solution of this make-or-buy-power question. Conditions governing the answer vary too widely. But engineering knowledge backed by experience permits a classification of several sets of conditions under which it may or may not pay to buy all or a part of the power requirements. See the accompanying table. This classification cannot safely be used for a final decision of any case, but it is helpful in directing a thoughtful investigation.

Two cases in which industrial managements acted

merely upon a knowledge of general principles instead of a quantitative engineering cost analysis illustrate the old saying that a little knowledge may be a dangerous thing.

Case one was that of a large manufacturing plant where, owing to an extensive use of 20-lb. process steam, the management determined to build a very costly power plant to supply all services, make more than half their energy as byproduct, and dispense entirely with public service power. On general principles this was a natural conclusion to reach.

Actually, however, an analytical and quantitative study of all conditions, followed by expert negotiations with the local power company for better rates, completely reversed the conclusion.

### Look Under Every Stone

Case two illustrates the same point. The plant operated a large power unit only during the heating season when its exhaust could be utilized, and bought the balance of power requirements. They knew the general principles as to the economy of using exhaust steam.

But they lost $15,000 to $20,000 a year for many years because they did not know quite enough. That same unit, if operated with its condenser equipment in the warm seasons, would have saved that amount over buying the equivalent power. This fact was discovered by a definite engineering cost analysis of conditions.

Many industrial power plants are so old and in such bad condition that a considerable saving could be made immediately by going over to purchased power, but that is only half the story. A second comparison should be made to show how much, if any, saving could be made by purchasing power as against the saving which *could* be effected by thoroughly modernizing the power plant.

There is one very common and costly error which catches many a good business man in his fight with his power problem. A selling organization is permitted to enter the plant and make a survey. This results in a report which shows the extent of saving possible by installing the commodity which this organization sells.

Numerous reports of this nature have been placed in my hands by clients and as a rule the reports are good.

But this is where the business man is likely to make his mistake if he acts without a competent and unbiased check. For the chances are that, although all predicted savings may be possible, there exists some other solution which surpasses any such piecemeal improvement.

This principle applies to the question of buying power as well as equipment. Whereas many plants would save money by buying their entire power requirements, many of these same plants would save far more money either by buying only a part and generating the balance, or in other cases by reconditioning and modernizing and generating it all. No stone should be left unturned in the study of the power problem. The business man often overlooks the fact that each selling company usually has a very limited variety of stones in its basket, and therefore is likely to leave many other stones unturned.

Fuel is the greatest single item entering into the cost of power (except in water power). The average fuel per kilowatt-hour consumed by the central station industry in this country is 1½ pounds of coal. The coal to

## *It Pays to Buy Power—*

1. It pays to buy power—if the rates are right—in plants of small and of moderate power demand where there is little or no need for heat for manufacturing processes or for the heating of buildings.

2. It pays to buy power in plants even where power can be made more cheaply than the purchased power can be bought, under certain special circumstances. For example, where to make power economically would require a considerable capital investment for power equipment or improvement and also where, at the same time, the limited capital available could be turned over much more rapidly in improving the production end of the business.

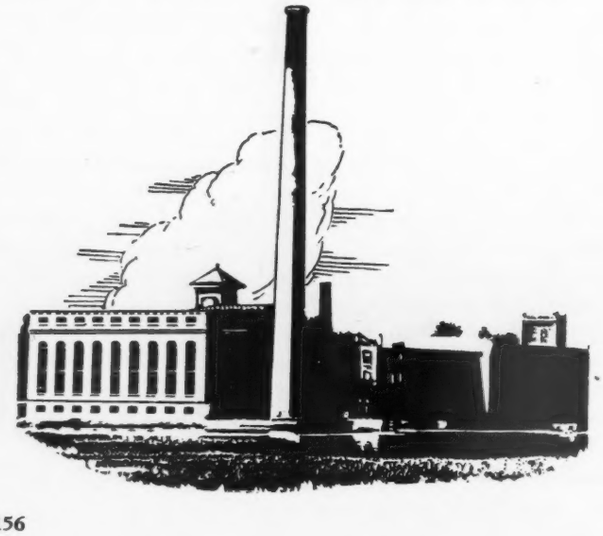
3. It may pay to buy power in plants of large power consumption where a highly developed superpower system makes the cost of purchased power almost as low as that at which it could be generated on the owner's property.

4. It may pay to buy power in plants of any size where the owner's business policies are unsettled or where his business may be growing so very rapidly that he does not desire to risk building a power plant which in a very short time would be unsuited to his needs, not only in size of steam generating and power units, but also in type of equipment.

5. It may pay to buy part of the power requirements. There are two general sets of conditions favorable to this solution of the question.

   First, there is the plant wherein all the exhaust steam from existing power units can be used for heating and process work but where the byproduct power so generated is insufficient to meet requirements. Here the best economy may be served by purchasing the balance of energy needed.

   Secondly, there is the plant where the exhaust steam can be used in the heating months only and would be wasted in the non-heating months. Purchase of power at suitable rates in the warm months may result in better economy than operating non-condensing engines and turbines or diesel units.



## *It Pays to Make Power—*

1. It pays to generate and not to buy power, in the smallest to the largest establishments, when all of the exhaust steam from the power units can be utilized for heating or for process work. Exhaust steam can now be delivered at high pressures (100 to 300 lb. and higher) from power units served by high-pressure boilers. Hence, the number of manufacturing plants which can profit by generating their own power has largely increased. Even a little factory plant with a 100-kilowatt engine generator set, using all its exhaust steam, may generate a kilowatt-hour for ½ lb. of coal above the quantity that would be used for the heating alone with the engine shut down. This ½ lb. compares with the 1.5 lb. per kilowatt-hour required by the average central station.

2. It is usually cheaper to make than to buy power when the steam heating, or the process load which could be supplied by exhaust steam, is relatively large in comparison to the power load. Thus if one-half of the engine or turbine exhaust be utilized to replace direct steam from the boilers, the fuel cost of power is almost halved. This applies to plants of all sizes. Where the heating load is fluctuating or seasonal, but of sufficient amount, high efficiency can be maintained by combining condensing and non-condensing power units to balance the requirements at all times. Or such a steam balance may be very simply secured by use of the bleeder type of turbine-generator.

3. It may pay to generate instead of buy power when there is a moderate to large power demand continued for a good part of the 24 hours, even when there is no heating load or use for exhaust steam. Under these conditions the overhead charge per kilowatt-hour is small, and a power plant of simple but efficient design can be operated very economically.

4. Another condition favorable to making power on the owner's property may frequently exist when a considerable boiler-plant must in any event be maintained for heating or process work. It may here be possible to install an economical power unit without adding boiler capacity, so that there is no added overhead charge except for the power unit itself.

generate a kilowatt-hour in industry varies from ½ pound and less up to 10 pounds. The ½-lb. economy is attained when the industry can make what is known as byproduct power. That means the exhaust heat from its power units is utilized to replace direct steam from the boilers for heating or process purposes. In such cases about 90 per cent (depending on steam conditions) of the steam heat fed to the power unit replaces its equivalent "live steam" for manufacturing purposes.

The prime mover can extract only a limited percentage of the heat; the balance goes either to the processing or, in the central station, to the condenser. In the latter type of plant in spite of the best that engineers can do to improve turbine-generator efficiency, an average of about 60 per cent of the heat entering the turbine throttle is rejected through the condenser and this helps to keep the fish warm in the river. This leaves 40 per cent to be accounted for and is composed of about 25 per cent efficiency of the turbine-generator and the balance of 15 per cent made up of radiation, friction, electrical losses, and bled steam for feed water heating.

Let us now take a parallel accounting of heat balances in two such plants, assuming each has a boiler efficiency of 85 per cent and the high generating-unit efficiency of 27.1 per cent for the central station and 4.7 per cent for a back-pressure turbine unit generating byproduct power. This means that of the heat of the fuel in the central plant 27.1 × 85 per cent = 23 per cent will be converted to electric energy and 4.7 × 85 per cent = 4 per cent in the industrial plant, which, however, delivers in addition 70 per cent for process and heating.

### Heat Balance

| | Byproduct Industrial Per Cent | Central Sta. Plant Per Cent |
|---|---|---|
| Heat of fuel to boiler plant losses | 15 | 15 |
| Heat of fuel to power | 4 | 23 |
| Heat of fuel to frictional, electrical, radiation losses | 11 | 7 |
| Heat of fuel to condenser loss | 0 | 55 |
| Heat of fuel to process or heating to replace boiler steam | 70 | 0 |
| Total heat of fuel | 100 | 100 |
| Per cent of heat of fuel to useful purposes | 74 | 23 |

In these typical heat balances with the industrial plant using all its exhaust steam, it is seen that its ultimate fuel utilization is over three times that of the highly developed plant making energy alone.

Of course fuel is by no means the only consideration in comparing the costs of purchased versus generated power, and all the others must be analyzed and compared. Power cost items may be classified as in the accompanying table, which indicates changes that may

### Power Cost Items

| Item | Generated Power | Purchased Power |
|---|---|---|
| Fuel | May use more fuel. Modernizing old plant will reduce this quantity and cost. | May use less fuel, but fuel for heating and process must be continued |
| Supplies | More supplies. | Less supplies but supplies for boiler house still needed. |
| Labor | More labor, but modernizing may reduce amount. | Less labor, but steam still requires some. |
| Maintenance and repairs | More of these items which, however, modernization may reduce. | Less of these items. For boiler plant may be the same. |
| Fixed charges | New fixed charges if plant is to be improved, otherwise none. | New fixed charges caused by installation of purchased power. |
| Purchased power | None if all power is generated. | Cost of purchased power including transformer losses. |
| Total | Sum | Sum |

occur in these items when power is generated and when it is purchased.

Improvements in the conditions for the use of purchased power may sometimes throw the decision in its favor. The charge for power is made up generally of two main items—energy charge and demand charge. A survey of the motor and electrical equipment in a plant will frequently discover means of reducing the consumption of energy. The demand charge may be reduced by cutting down peak loading, staggering machine startings, flattening out the load curve, taking advantage of low night rates, improving power factor.

In some instances power should be purchased instead of generated because the limited capital available can be turned over more rapidly by improvements in production than by investment in power generating equipment.

When more power is needed than can be supplied by existing generating units, the exhaust from which just balances process and heating requirements, the purchase of such additional power may be the most economical solution.

Large seasonal demands for heat from exhaust may indicate the use of purchased power during off-seasons when heating demand is little or nothing.

When power expansion is required, usually both capital investment and time can be reduced substantially by supplementing the existing supply with purchased current.

Then there are many cases in which a connection to the power company's supply economically relieves the necessity for reserve generating units which would otherwise be required to safeguard factory production. And hundreds of industries having week-end shutdowns may find a limited supply of public service power both convenient and economical.

Purchase of the whole power supply is highly economical in numerous situations, but that does not solve the steam supply problem; however, many owners seem to think that it does, judging by the appearance and wastefulness of their boiler plants. To be handled successfully the power problem must include consideration of the steam requirements. When all of the power is economically obtained by purchase, it is too bad to find such inefficient boiler plants still in operation.

Fifty per cent efficiency is common in many factory boiler plants. Since the efficiency could be raised to from 70 to 85 per cent by the necessary modernization, it seems a pity to neglect this end of the problem.

▼ ▼ ▼

# 90 in the Shade

***But only 75 in the Sun Tube Company's air-conditioned plant. Operators like to work, won't stay home***

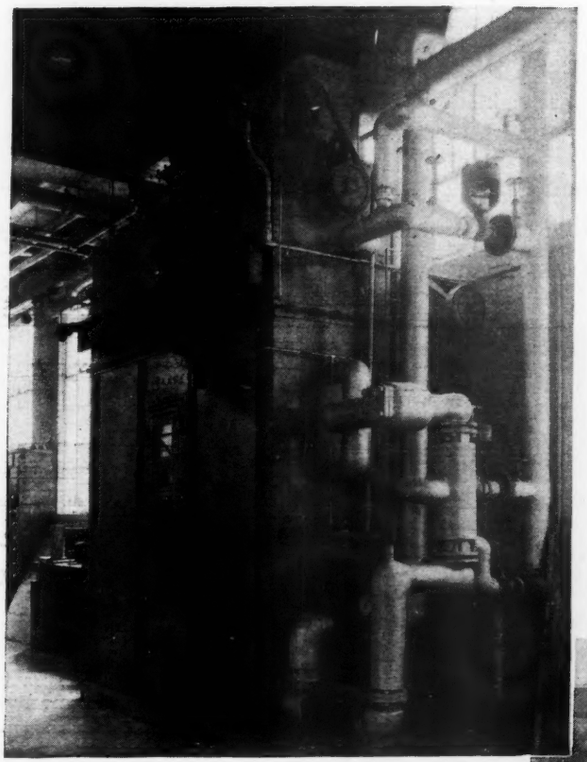
IF YOU'VE ever stepped from a sizzling summer street into a cool movie—and who hasn't—you know exactly how employees of the Sun Tube Company feel about going to work on a broiling August day.

They don't, to be sure, find Clark Gable inside—90 per cent of them are women and would doubtless like to—but they *do* find the thermometer fifteen degrees lower than it is outdoors. That 15-deg. differential means real comfort on ordinary hot days and at least an illusion of comfort on those fairly rare occasions when the mercury climbs above the 100 mark.

Is it any wonder, then, that the women would rather go to work and be comfortable and get paid than stay at home and swelter?

Air conditioning is commonly installed because it is good for the product. Comfortable working conditions are merely a byproduct. Here, however, the customary order of things is reversed, for air conditioning has been installed simply because it is good for human beings and for no other apparent reason. If there has been any increase in production or improvement in quality, it just happened and had nothing to do with the original decision to condition the plant.

Certainly there is nothing about the product or the



Water at 48 to 50 degrees is pumped from a 275-ft. well to four unit air washers which wash and cool 40,000 cubic feet of air per minute and provide a complete change of atmosphere every five minutes. A slight improvement in the quality of the product is merely incidental to the management's determination to make a good plant a better plant to work in. Two of the four conditioning units are used to heat the plant in winter. They keep it at 68 degrees

process to make air conditioning a "must." The company makes collapsible tubes for toothpaste, shaving cream, cosmetics, shoe polish, and such. Essentially the process consists of taking a metal slug—pure tin if for a food product—and extruding it in the form of a tube. The extruded tube is then conveyed into a "combination" machine, gets a hole punched in the top so you can squeeze out the toothpaste when it reaches your bathroom shelf, is threaded so the cap can be screwed on, and cut off at the bottom to length.

Then begins a non-stop trek through a coating machine where the tubes get a base coat of paint, being taken at once on the spindles of an endless chain directly to and through a baking oven on the second floor. Baking done, down they come to a printing machine which completes the decorating job, and up they go for a second baking. Down once more, they are then lacquered, proceed at once through a fume exhaust system, and finally reach girls who pick them off the chain, screw on the caps, and pack the finished product in cartons.

The air conditioning equipment consists of four unit air washers. Water from a 275-ft. well is supplied to the washers at 48 to 50 degrees, at the rate of 500 gallons a minute if need be. The washers will wash and cool 40,000 cubic feet of fresh or recirculated air per minute, and will provide a complete change of air about every five minutes. There is no refrigeration. The well water never varies more than a degree or two, and is cold enough to do the trick. Operation is of course completely automatic and is designed to maintain a relative humidity of 50 per cent along with the 15-deg. drop in temperature previously mentioned.

A not unimportant part of the conditioning plan is the fume exhaust system which removes most of the highly objectionable odor given off by lacquer as it is applied and dries on the tubes. It must in frankness be admitted that there is still the unmistakable smell of lacquer around the plant, but it is not anywhere near thick enough to cut with a knife—as indeed it used to be.

So—a comfortable plant in which people like to work. Before it was conditioned, it was no less comfortable, perhaps it was even a bit bit *more* comfortable, than other unconditioned plants in hot weather. Baking ovens were then as now located on the otherwise unused second floor, far from the manufacturing scene and adding not at all to the workers' discomfort. It was in fact a good plant before, has become a better plant since it was air conditioned. Last summer, when the system got its first tryout, absenteeism was cut to a hitherto unheard-of figure. Attribute part of the improvement to the natural reluctance of operators to miss a chance to work under prevailing business conditions. Credit the balance to air conditioning.

It has been stated that the management thought only of comfortable working conditions and not at all of increased production and improved quality. That is true. It is equally true, however, that there has been an improvement in quality—a slight improvement, to be sure, but improvement all the same.

Formerly, freshly painted tubes could not help picking up small dust particles, usually not big enough to cause rejection of the product, but perhaps representing the difference between a good product and one that could be better. Today the air is washed and the dust is taken out. There isn't any in the air, and naturally none for the tubes to pick up.

So, after all, the product *is* better. Far more important, however, is the fact that this is a much more comfortable plant to work in than it used to be. What better reason than that for air conditioning?

# No Longer "Anybody's Job"

**One motion economist has designed, built, and used steel containers that standardize the heretofore casual task of setting up bench assembly work**

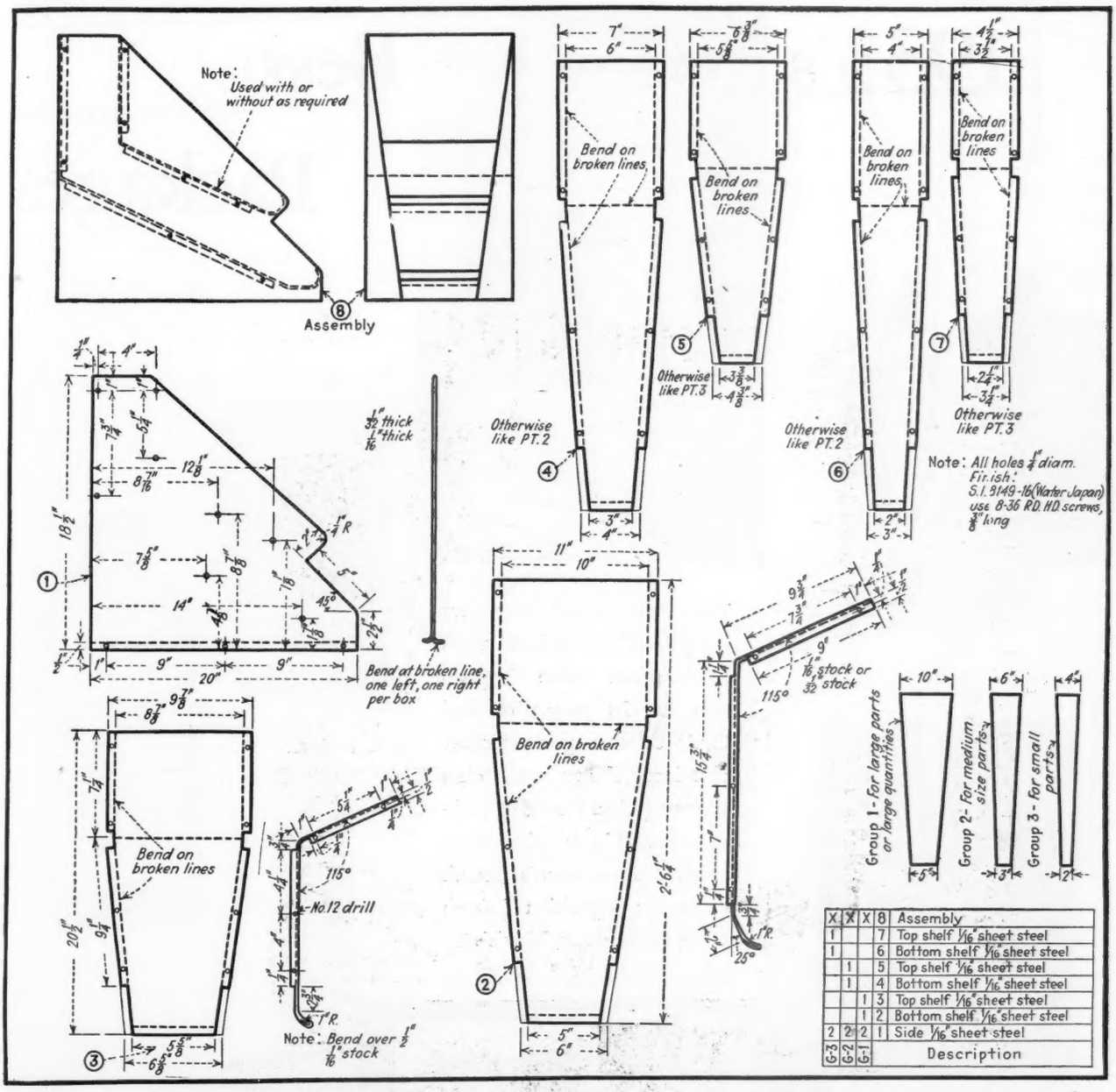
**A successful circular workplace is quickly assembled from the seven standardized parts shown in the detailed drawings —and as quickly disassembled when the job is done. Or the standard containers may be used to build a universal workplace where miscellaneous short runs can be more quickly and economically handled than when a hasty set-up must be knocked together for each individual job**

*R. E. Morrisey*
*Remington Arms Company*
*Bridgeport, Conn.*

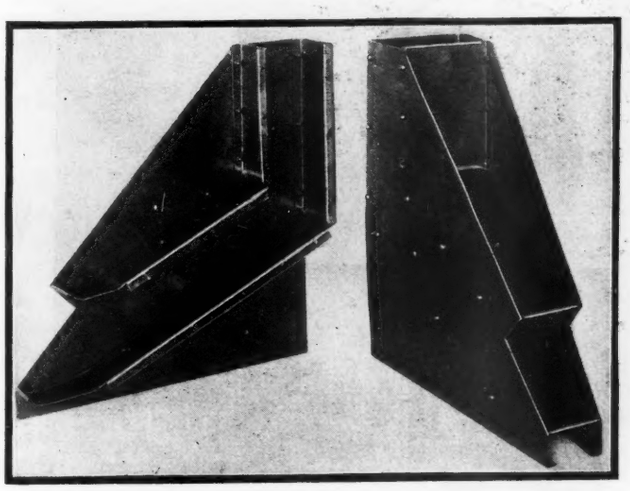
ALTHOUGH it is generally recognized that make-ready time is a considerable part of any job, the bench assembly set-up has been anybody's job. For proof of this one has only to visit any large manufacturing plant; the absence of any standards with respect to assembly set-ups is soon apparent.

Those of us who have had the responsibility for setting up a bench assembly for small or medium-sized apparatus know that a large part of the difficulty may be attributed to the fact that in making these set-ups we must resort to irregular or improvised tools. There are obvious advantages in having standard material containers suitable for the circular workplace.

These containers require no special tools. The standard shear and bending brake such as we find in any sheet-metal department are all the tools necessary.


Note: Used with or without as required
Assembly
Bend on broken lines
Otherwise like PT. 3
Otherwise like PT. 2
Note: All holes 1/4" diam. Finish: S.I. 3149-16 (Water Japan) use 8-36 R.D. H.D. screws, 3/8" long
1/32" thick
1/16" thick
Bend at broken line, one left, one right per box
No. 12 drill
Note: Bend over 1/16" stock
1/16" stock or 1/32" stock
Group 1 - For large parts or large quantities
Group 2 - For medium size parts
Group 3 - For small parts

| X | X | X | 8 | Assembly |
|---|---|---|---|---|
| 1 | | | 7 | Top shelf 1/16" sheet steel |
| 1 | | | 6 | Bottom shelf 1/16" sheet steel |
| | 1 | | 5 | Top shelf 1/16" sheet steel |
| | 1 | | 4 | Bottom shelf 1/16" sheet steel |
| | | 1 | 3 | Top shelf 1/16" sheet steel |
| | | 1 | 2 | Bottom shelf 1/16" sheet steel |
| 2 | 2 | 2 | 1 | Side 1/16" sheet steel |
| G-3 | G-2 | G-1 | | Description |



**Standard unit in partial and complete assembly. Screws and nuts permit easy disassembly for change or storage**

Seven standard parts are all that are required. From these standard parts, which may be carried in stock in knocked-down form, many combinations can be made up in a few minutes. Since the standard parts are held together with screws and nuts, they can be readily disassembled and put back into stock where the job is discontinued, or rearranged to suit another product.

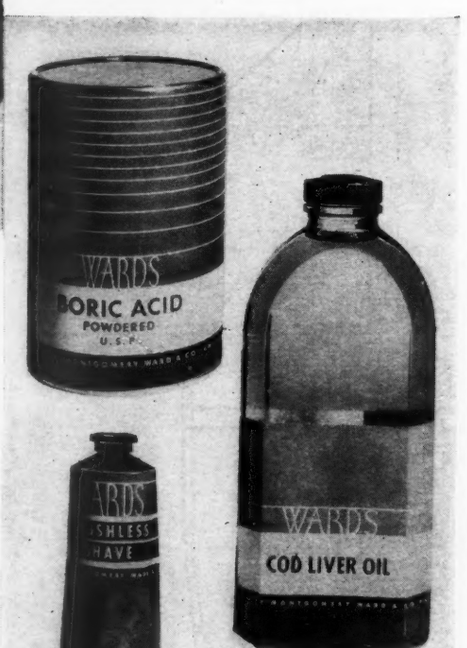
With these standard material containers it is also possible to set up a universal workplace where many miscellaneous small jobs can be handled much more economically than when such facilities are not available.

On the detailed drawings the material thickness is given as .060 inch. This is the maximum thickness used for these containers. A minimum thickness of .037 inch has been used when the component parts to be assembled were light enough to permit.

These containers are inexpensive, can be made up from common sheet steel at a direct labor cost of from 10 to 15 cents for each part in lots of 50 pieces.

# 1933's Best Packages

The Wolf Award Jury gave the pair of tall dirigold vases to American Coffee Corporation for its persuasive Red Circle Coffee bag. The other containers shown were class winners picked from 312 packages entered in American Management Association's Fourth Packaging Exposition (March 11-16, Hotel Astor, New York)



For ingenuity, Valentine self-stirring can . . . best glass container, canister, tube—Ward's . . . . visible display, Webster's Micrometric Carbon Paper . . . best family of packages, Kingan's . . . best plastic container, Lektrolite—Hostess Cigarette Lighter

*Data Sheet*

# Unemployment Insurance

SOURCE, Unemployment Insurance Handbook
National Association of Manufacturers

## World Extent

| *Compulsory Systems* | | *Voluntary Systems* | |
|---|---|---|---|
| Austria | 1920 | Belgium | 1920 |
| Bulgaria | 1925 | Czechoslovakia | 1921 |
| Germany | 1927 | Denmark | 1927 |
| Great Britain and Northern Ireland | 1911 | Finland | 1917 |
| Irish Free State | 1920 | France | 1905 |
| Italy | 1919 | Netherlands | 1916 |
| Luxemburg* | 1921 | Norway | 1915 |
| Poland | 1924 | Spain* | 1931 |
| Queensland (Australia) | 1922 | Mixed System: Switzerland | 1924 |

* Not in operation.

## Coverage

| *Compulsory Systems* | Per Cent Insured of Gainfully Occupied Persons | Per Cent Insured of Total Workers | *Voluntary Systems* | Per Cent Insured of Gainfully Occupied Persons | Per Cent Insured of Total Workers |
|---|---|---|---|---|---|
| Great Britain | 63.5 | 75.0 | Czechoslovakia | 28.0 | 40.0 |
| Australia: | | | Denmark | 21.0 | 35.0 |
| Queensland | 52.4 | * | | | |
| Germany | 48.7 | 75.0 | Belgium | 20.0 | 25.0 |
| Austria | 38.0 | 54.0 | Switzerland | 17.5 | 40.0 |
| Italy | 23.0 | * | Netherlands | 16.0 | 35.0 |
| Irish Free State | 16.0 | * | Finland | 5.0 | * |
| Bulgaria | 12.0 | * | Norway | 3.3 | * |
| Poland | 9.0 | * | France | 1.5 | * |

* Data not available.

Compulsory systems are those in which unemployment insurance is made obligatory for certain designated classes of workers and under definite conditions prescribed by law. Voluntary systems are those in which unemployment insurance through private organizations is recognized, encouraged, and even subsidized by the State, but the establishment of such insurance is not obligatory.

Under the compulsory insurance laws the following classes are as a rule entirely excluded: (a) Agricultural workers, (b) employees in small establishments, (c) independent workers, (d) domestic servants, and (e) casual and seasonal workers.

The table gives the approximate coverage of each of the 16 foreign systems now in operation, as measured by (1) the percentage that the insured persons form of the gainfully occupied persons in the country, and (2) as far as available the percentage that the insured persons form of the wage-earning population.

## Principal Features of Chief American Proposals

SCORES of bills have been introduced in state legislatures to establish systems of compulsory public unemployment insurance. But there have been a few proposals upon which these are mostly based.

Some, for example, follow the Wisconsin law; others may resemble more closely the proposal of the American Association for Labor Legislation (A.A.L.L.) or the recommendations of the Ohio Commission on Unemployment Insurance. The American Federation of Labor and the Socialist Party have likewise prepared recommendations, as has the "Interstate Commission on Unemployment Insurance," comprising representatives appointed by the governors of New York, Ohio, Massachusetts, Pennsylvania, New Jersey, and Connecticut.

In addition to the subsequent analysis of the principal points of these six proposals (see next page), the following deserve special mention:

1. The Wisconsin law provides that under certain conditions a company may provide its own plant system of unemployment reserves, but specifies that it shall not be permitted to do so through insuring with "any insurance company"—which seems an arbitrary discrimination against a legitimate private industry; the A. F. of L. (American Federation of Labor) proposal also provides for such exclusion of private insurance companies.

2. The A. F. of L. proposal endeavors to promote the closed shop idea (permitting employment only to labor union members) through the medium of public unemployment insurance. Thus it says that such acts "should contain specific provisions to protect union members from being obliged to accept work contrary to the rules and regulations of their organizations"—which rules provide in most cases that union members must work in closed shops: i.e., shops which exclude workers because they do not carry a union card.

3. Most of the proposals contain language such as the following quotation from the Wisconsin Act, providing that benefits shall not be paid an applicant if employment has been lost "through misconduct" or "if he has left his employment voluntarily without good cause." The A. F. of L. proposal, however, greatly modifies these safeguards against abuse by providing that "workers who quit work without good cause or who are discharged for misconduct shall not thereby forfeit benefits beyond a reasonable period."

4. The Ohio Commission's proposal provides for a "merit rating" of employers, after the act has been in operation for a few years, under which employers who provide more steady work may have their premiums reduced as low as 1 per cent (the law provides for 2 per cent) and those with a large volume of unemployment may have their rates raised to as high as 3½ per cent.

5. All of the proposals provide for the establishment of a system of state employment offices.

6. The proposal of the People's Lobby, headed by John Dewey and Benjamin Marsh (not analyzed here), provides that the Government pay all costs.

*(Continued on next page)*

*Data Sheet*

# Unemployment Insurance

*(Continued from previous page)*

## Tabulated Comparison of Chief American Proposals

| *Subject* | *Wisconsin Law* | *Interstate Commission* | *A. A. L. L.* | *A. F. of L.* | *Ohio* | *Socialist* |
|---|---|---|---|---|---|---|
| Coverage. | Employers of 10 or more persons; employees receiving $1,500 or less. | Employers of 6 or more persons; employees receiving less than $200 monthly. | Employers of 6 or more workers. | Same as workmen's compensation. | Employers of 3 or more persons; limit of $2,000 yearly. | All employers limit of $3,000 yearly. |
| Exclusions. | Farm laborers, domestic servants, public officers, school teachers, interstate railroad employees. | Farm laborers. | Farm laborers; non-manual workers receiving $1,500 or more per year. | Same as above. | Public corporations; farmers, interstate commerce employees, farm laborers, domestics, public agencies. | |
| Contributions. | By employers only. | Employers only. | Employers only. | Employers only. | By employers and workers. | 50% by state and 50% by employers. |
| Rate of contributions. | 2% for first two years; thereafter 1% when reserve per employee is $55-$75; nothing when reserve per employee is $75 or more. | 2% of payroll; 1% for average employee reserve of $50-$75, and no payment when reserve per employee is $75 or over. | 1½% of payroll. | 3% of payroll. | 2% of payroll by employers and 1% by workers. | Sufficient to pay benefits. |
| Waiting Period. | 2 weeks. | Not specified. | 2 weeks. | Not specified. | 3 weeks. | 1 week. |
| Benefits. | $10 per week or 50% of average weekly wage, whichever is lower; benefits may be reduced in amount or duration if employer's fund is unable to meet full payments. | Substantially same as Wisconsin. | $10 or 60%, whichever is lower; benefits may be reduced according to the status of the industry fund. | As much as fund status permits. | 50% of wages, not to exceed $15 weekly. | 50% plus allowance for dependents; limit $25 weekly. |
| Maximum duration of benefits. | 10 weeks in year. | 10 weeks in year. | 13 weeks in year. | As long as fund status permits. | 16 weeks in year. | |
| Administration. | By state industrial commission. | State industrial commission or special state unemployment commission. | Department of Labor. | State unemployment commission. | State unemployment commission. | State unemployment Insurance Board. |
| Eligibility for Receipts. | No payment for unemployment due to misconduct, voluntary quits, trade disputes, or refusal to accept "suitable employment." | | Employment in state 26 weeks in two preceding years; unable to obtain "suitable employment." | Practically no restrictions as long as unable to secure employment for which "reasonably fitted." | Contributions for 26 weeks in year or 40 weeks in 2 years "suitable employment" provision. | "Suitable employment" provision. |
| Nature of Fund. | Separate fund for each employer. | Separate fund for each company. | Separate fund for each industry. | One fund for all companies in state. | Same as A. F. of L. | Same as A. F. of L. |
| Exemption from contributions. | Companies guaranteeing 42 weeks work in yr. or having a plan approved by the commission. | | Employers showing financial ability to pay benefits or having plan giving at least equal benefits. | | Self-insurance might be permitted after 2 or 3 years. | |

# Production Control

## 11.—Inspection Routine

*Thomas M. Landy*

PRODUCTION planning and control cannot be said to be complete unless it has been carried through to the point of final inspection. Therefore, while inspections made in between operations are carried on in the usual way, it is advisable to tie the final inspection in with the routine of the dispatch station (see January, page 15).

In a department with a relatively long manufacturing cycle, the inspector is handed a voucher and a drawing of the job. When the work has been inspected, the okayed voucher and the drawing are returned to the dispatch station. Sometimes it is also found desirable to have the inspector punch the identification tag, which accompanies the job, as well as the workmen's vouchers.

When work is defective, the inspector's voucher is so marked. If an inspector's report (Figure 1) is necessary, it is brought to the dispatcher with the voucher and drawing. It is then attached to the dispatch order and placed in the foreman's hold-up file.

If part of an order is defective, that part is placed on the foreman's "red skid" (defective work station), and the balance is held at the inspector's station pending repair of the defective portion. If part of the order is scrap, the quantities on all paper are reduced.

The following routine is probably more satisfactory in departments which are conveyorized, or in any department with a large turnover.

When the material arrives at the inspector's station it has a checker's copy attached to the identification tag. If the work is okay, the inspector merely punches the tag or voucher, and turns in the checker's copy to the dispatch station where it acts as a release for the dispatch copy of the order.

If part of the material is defective or scrap, the inspector follows the routine that has already been described.

### Defective Material

Defective work, like the poor, we have always with us. Hence a definite routine must be set up to take care of this disagreeable angle of manufacturing. It will vary somewhat with the type of work.

1. *Material on machine floor*—When the inspector turns down a job, the order is held up, and the rejected parts are blue-tagged and placed on the foreman's red skid. The foreman then decides whether an inspector's report or a spoilage deduction voucher (Figure 2) is required. The former is made out for any defective work involving a loss of more than $3. The latter is used when the defective work or omitted operation is clearly the workman's fault. It may be used either as a deduction from his pay when the error cannot be corrected or as a work voucher when the operation was omitted and the error can be corrected. An extra cost report (Figure 3) is used when the expenditure involved is $3 or less. The foreman makes it out; the inspector signs it, then turns it over to the dispatcher who handles it like a regular inspector's report.

Where the inspector's report is necessary, it is turned over to the foreman who writes in the cycle of operations. It is then given to the dispatcher who attaches it to the dispatch order in the foreman's hold-up file and sends them to the planning office for pricing and a set of time vouchers. Upon return the dispatcher handles the whole order as if it were a new one, placing the dispatch

DEFECTIVE WORK, MATERIAL AND OTHER LOSSES

Reported by: John Doe | Date: 4/10/30 | Inspector's Report No. 1 to 50,000 | Supersedes No.

Quantity: 1 | Article: Bearing MCF-6-500 | Kind of Material: Cast Iron

DL—ML—Dwg—Pt—Gp—Spec.—Patt—Cat. Model—Machine: | Received on Order No. | Located: #0 Brown | Manufactured on S. O.: 00000

No. 00000

RECEIVED FROM: (1) Home Works: Foundry #00 | (2) Allied Works | (3) Outside Vendors | For Shipment on Req'n No.

Nature of Defects, or Loss: Gas Holes in joint face

W. W. Wagner

| CAUSE (Mark "X" in proper square) | | |
|---|---|---|
| Engineering changes and errors | 1 | |
| Defective material | | X |
| Defective workmanship | 3 | |
| Damaged and lost material (mis-handling) | 4 | |
| Surplus and obsolete material | 5 | |
| Other losses (not otherwise classified) | 6 | |
| Failure in test (not otherwise classified) | 7 | |

Correct defects on S. O.

Charge to

Fault of: Name ?

Employed in Foundry

Dept. Bldg. 95

Condition of material

| (1) Raw | (2) Operations performed | (3) Fin. |
|---|---|---|
| | Joint Milled | |

Copies to: J.M.H. C.W.H. John Brown

J. Smith

E. Jones

Data in this block to be filled in by Cost Dept.

Apparatus Symbol .....

Dept. No.

| Fault No. | Eng'n 1 | Outside Mfr. 2 | Com'l 3 | Factory 4 |
|---|---|---|---|---|
| Material | | | Home Foundry Material | Weight each |
| Labor | | | | Weight total |
| Factory overhead | | | | Class or Alloy No. |
| Shop cost | | | | |
| Scrap value | | | | Mach. shop labor |
| Loss | | | | |

Absorbed in cost: Yes..... No.....

DISPOSITION OF MATERIAL

| (1) Passed | (2) Corrected | (3) Use to advantage | (4) Condemned | (5) Rejected (scrap here) |
|---|---|---|---|---|
| | | | X | |

Figure 1

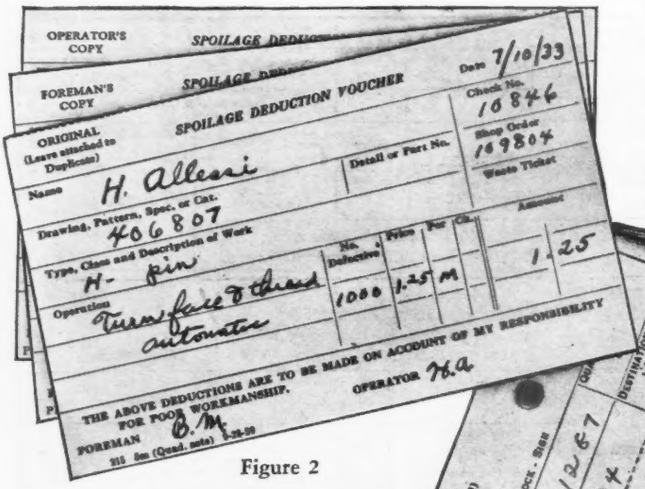



Figure 2

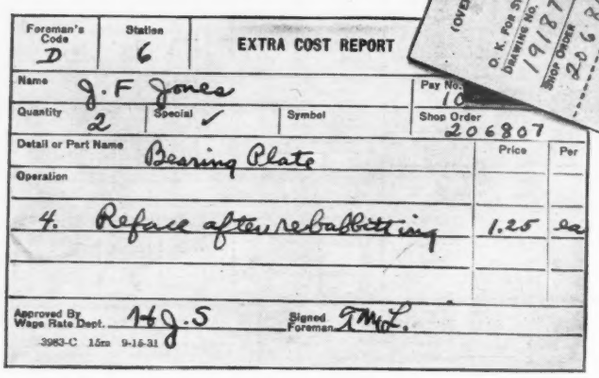



Figure 3

order vouchers in the proper pocket on the dispatch board and ordering the defective material moved from the red skid to the first operation.

When the spoilage deduction voucher is used, the foreman has the operator sign it, keeps a copy as a check on the work, turns the other copies over to the dispatcher. The latter then attaches a copy to the dispatch order in the foreman's hold-up file, gives it to the operator, and orders the work removed from the red skid to the work station. After the parts have been repaired, they join the balance of the order which has meanwhile been held up at the inspector's station.

*2. Material in stock to be corrected and returned to stock*—The inspector issues a material correction notice (Figure 4) consisting of three carbon-backed copies and a blue tag. All four go to the planning office for scheduling. Dates are inserted; one copy and the blue tag are sent to the stockkeeper; the other two are held for routing and pricing.

The planner and the foreman decide whether the operator is to be charged, and then either the inspector's report or the spoilage deduction voucher goes to the dispatch station with the two planning copies of the correction notice. One serves as an index, the other as a dispatch order. From this point on, the regular dispatching routine is followed.

Upon receipt of his two copies, the stockkeeper attaches the blue tag to the material, makes a notation on the stock card against the shop order being withdrawn, and attaches the other copy to the location card. He then sends the material to the incoming material station of the department which must do the work or to the specific work station if the planner has noted it on the tag.

After the correction has been made, the inspector removes the blue tag and signs the stub to show that the work is "O.K. for stock." The material is then delivered to the stockroom; the stock correction notice is removed from the location card; quantity is checked; and the copy is passed to the stockcard clerk for posting.

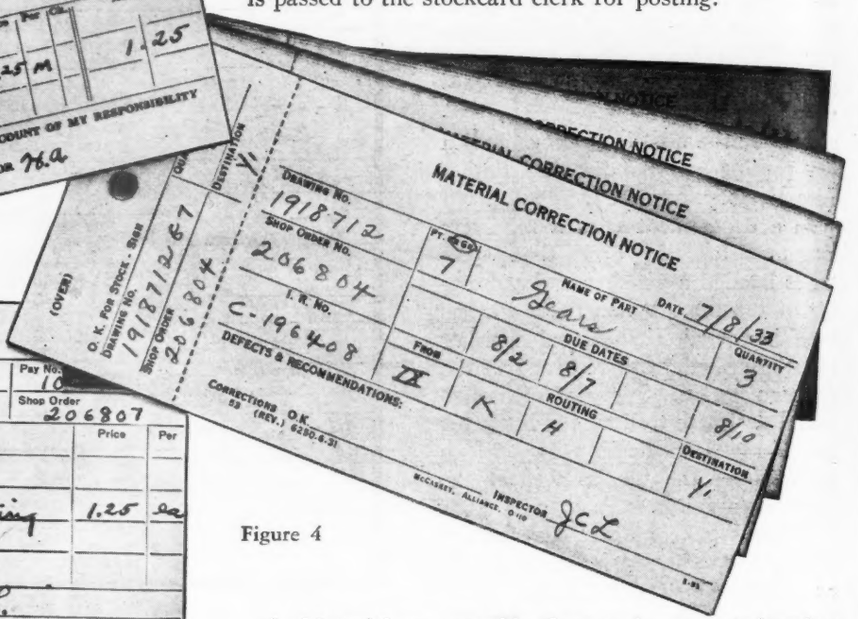



Figure 4

*3. Material on assembly floor to be corrected and returned to stock*—The same routine is followed, except that the stockkeeper need not make any note on the stock card, the withdrawal having been made when the material was delivered to the assembly floor. The change must be made on the stock card, however, after the material has been corrected and return to stock.

*4. Material on assembly floor to be corrected and returned*—The inspector makes out the correction notice, turns it over to the planning section, which handles it as in the above cases except that the stockkeeper's copy and blue tag are sent to the assembly floor foreman. The latter retains the stockkeeper's copy, attaches tag to material, and sends latter to the department which is to perform the work. When the correction has been made, the material is returned to the assembly floor. In this case no paper passes through the stockroom.

### Advantages

1. Quick turnover of defective materials; defective work prevented from being sidetracked and allowed to pile up on factory floors.
2. Mechanical responsibility placed with the department foreman; production responsibility, with the production control section.
3. Carelessness reduced because the whole burden of correction falls back upon the foreman and the operator.
4. Labor and clerical effort kept at minimum.

•

**A twelfth and final article will outline cost accounting procedure as it is related to the major factory problem of production planning and control**

*Jack may become a duller boy unless his free time is constructively used. Industry shares the responsibility of seeing that it is*

# New Leisure

## *and a new job for management*

*William Butterworth*

*President, Deere & Company, Moline, Ill.*
*Formerly President, United States Chamber of Commerce*

WHEN IN 1841 weavers in Massachusetts cotton mills worked 84 hours a week and in 1855 shoemakers labored 72 hours, there was not much public discussion on how a man was to fill up his leisure time. He had no leisure worth mentioning. Today, as a result of invention and improved methods, a substantial and increasing amount of leisure is a reality for the factory worker and many others in industry.

The 1933 reduced hours of work do not represent radical changes suddenly introduced. They are a gradual development. In March, 1932, Roger Babson pointed out in an article in the Boston *Transcript* that the five-day week was in successful operation in some of the largest industries. "Five and one-half per cent of all industrial workers have a five-day week—44 per cent of all automobile employees, nearly 60 per cent of all building trade workers, 34 per cent of the radio workers, 27 per cent of the aircraft workers, and 15 per cent of the woolen mill employees," he stated. "This includes only plants that have adopted the five-day week as a permanent policy, not those plants temporarily operating five days or less because of the depression."

The Western Electric Company, Ford Motor Company, Standard Oil of New Jersey, The American Telephone and Telegraph Company, and many other large organizations were on a five-day week before the shorter working week movement of the last few months.

It is clear, then, that the reduction of labor hours is in perfect accord with tendencies long since in evidence. More spare time promises to be a permanent feature of our economic and social life. The question of the consumption of this spare time is momentous and deserves the serious consideration of employers, governmental agencies, and the general public.

The relation of added leisure to the consumption of commodities is an important and fascinating subject. If one traces our industrial and social life since the turn of the century, he observes that the steady increase of leisure has been accompanied by the emergence to major importance of industries and services related to the public's free time. The automobile industry, radio, motion pictures, sporting goods, amusement parks, beauty culture, and the travel industry were born to a large extent of the shortening work hours of men and women and the growth of vacations. The revival of the steel industry in the late spring and summer of 1933 came principally as a result of the demand for materials from the automobile manufacturers.

### How Will Leisure Affect Work?

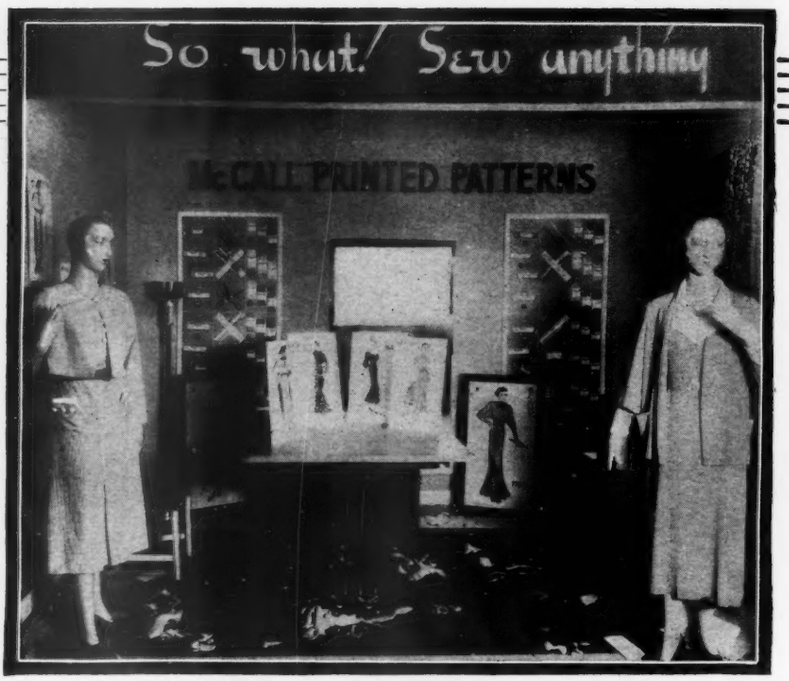
However, it is leisure as a problem of importance to efficiency and good citizenship that I wish to discuss here. In this respect the new leisure presents a problem of great importance to the efficiency and good citizenship of the individual. The question is, What is to be the effect of large blocks of free time on the individual's productive power as a member of our industrial society? A

permanent condition has now arisen in which millions have in the total literally years of free time which our ancestors only dreamed of enjoying. In every country there had been a small leisure class which knew little or nothing about working for a living, but now the men and women near the bottom of the industrial ladder are in a real sense members of the leisure class. By a strange paradox it is the business executive, the professional man, and the banker who work the longer hours. Of course it is only just that those who do the least interesting work of the world should have less of it to do. It is of public concern, however, that the new-found spare time shall be used to reasonable advantage and that it shall not become a drag on either good workmanship or good citizenship.

It would seem that the time has come for facing up to the implications of leisure and planning for its constructive use. Just as a death blow has been dealt the principle of *laissez faire* in industry, just so the idea of unplanned leisure must be given up. The community cannot hide behind the evasion that a man's free time is his own business and no one should intrude. Society should be just as much concerned with the use of leisure as it is with the injustice of overwork. The danger now is not that men and women will seek escape from excessive fatigue in drunkenness and vice, but rather that they may waste their new leisure in ways that damage their efficiency and are entirely neutral to their personal development. What the individual does with his spare time is of concern to the employer and the community, and there is nothing paternalistic in their giving thought to ways in which leisure may be constructively employed.

•

**In March the Kellogg Company, on a six-hour day since 1930, asked 133 factory workers how they spend the extra two hours. Eighty-four per cent of the men, 68 per cent of the women, read more; 64 and 44 per cent do more gardening; 59 and 24 give more leisure time to sports; 34 and 27 devote more to general recreation. Which means someone sells more books, magazines, and newspapers, more garden tools, more ping pong sets and automobiles**




*Photos, courtesy R. H. Macy & Company*

**A New York department store and 65 cooperating manufacturers are quick to recognize increased leisure as a permanent feature of our economic and social life. Just as quickly—if not so altruistically—do they visualize widening markets**

The question then rises, "What activities make for personal development and efficiency in leisure?" They are to be found, I believe, not so much in the field of amusements and entertainment as in that of recreation —and, of course, self-improvement and community service. By amusement I mean all those things which are primarily passive, in which one is entertained by others. By recreation, I mean those things in which the individual is himself an active agent, such as playing golf, tennis, baseball, and other games, swimming, sailing, hiking, picnicking, purposeful motoring, music making, drawing, painting, sculpture, hand work of all kinds, taking part in dramatics, collecting stamps or other things, and dancing.

To bring recreational opportunities to the public at large, it is not necessary to set up new machinery. We have the machinery. The difficulty is that it has not been given sufficient application and adequate support. The task is to build on the foundations that have already been laid. During the last quarter century the country has seen the growth of child and youth movements such as public playgrounds, boy and girl scouts, Y.M.C.A., Y.W.C.A., Y.M.H.A., Y.W.H.A., Jewish centers, Columbian Squires, settlements, camp fire girls, boys' clubs, and other agencies which give instruction in recreation skills and provide facilities and guidance.

### Planned Leisure Is Needed

Practically every known form of outdoor recreation and every type of civic service feasible for youth is included in the scope of these organizations. Private camps and commercial recreational concerns have played a part in recreational training. The schools have made training for leisure one of their seven cardinal objectives and

**"No one is in debt to Macy's" is that store's oft-repeated boast. But 328,035 members of the newer "leisure class" visited the Hobby Show (February 19—March 10), so are indebted to Macy's for suggesting new and better ways to use free time**

are steadily putting into the curriculum the training that prepares boys and girls for living, as well as making a living. The beginning the schools have made in this direction should be extended so that every schoolchild, rural and urban, could be trained in attitudes and skills for leisure.

All these agencies have provided recreational opportunities, taught recreational skills, and implanted a disposition toward constructive leisure activities.

### Municipal Recreation an Economy

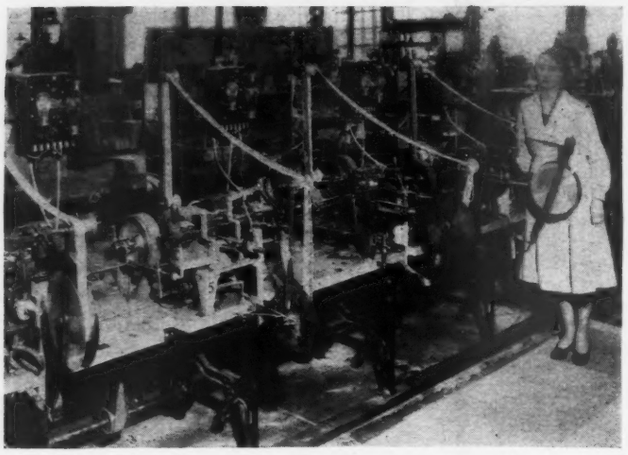
However, it is of no use to provide this training unless there are to be adequate opportunities to practice skills after graduation from school. There is demanded a community statesmanship that will provide parks, athletic fields, playgrounds, swimming pools and bathing beaches, tennis courts, evening community centers, art classes, musical and dramatic organizations, on a scale sufficient to accommodate the public. I believe strongly, of course, in evening educational courses, libraries, museums, and art galleries, but I am of the opinion that at the present time there are 25 persons who can profit by public recreational facilities to one who can be attracted to undertake serious study. The obtaining of adequate recreational opportunities rests, I am convinced, in the extension of municipal and county governmental functions to recreation. There will always be a place as heretofore for the experimental and pioneer work of the privately supported and administered recreational agencies. We have now reached the stage where recreation must be conducted on a community-wide basis, cutting across lines of religion and classes, taking in all who work with their hands and white-collar employees as well. Municipal or county control is in the long run the most democratic, the most permanent, the most effective, the least expensive way to do it.

To advocates of indiscriminate economy in government, this will seem an inopportune time to suggest that a broad program of public recreation is essential. These advocates have already so strongly pressed their ideas that municipal recreation budgets for the country were 28 per cent less in 1932 than in 1929, in spite of the fact that the public demand for recreation particularly among unemployed adults enormously increased. In terms of public morale, physical vigor and efficiency, industrial productivity, personal development and good citizenship expenditure of tax funds for recreation is a sound investment. The ill health, mental disease, delinquency, and crime, which in part are the result of misused leisure and are costing taxpayers enormous sums each year, might be reduced by the preventive power of recreation. A little recreation saves trouble and money, and is not in any sense of the word costly.

Municipal recreation is inexpensive recreation. In New York City, for instance, the outlay of $1,600,000 in 1932 was but one-fifth of one per cent of the total budget of the city. The New York City programs recorded more than 40,000,000 attendances at a cost of 22 cents per capita population. In other words, for the cost of one admission to movies or half hour of playing pool, for the price of one or two packages of cigarettes, the citizens of New York provided for themselves and their children a recreational program available 365 days in the year. Among all the departments of local governments those that serve the people's leisure should be the last to receive drastic budget cuts. It is true that they should be economically administered and efficiently operated, that they should be absolutely free from political domination, but in these times and in times to come their functions should be enlarged rather than decreased.

Since it is clear that we are moving into an era of leisure, it is to the interest of government, industry, and the general public to lay broad plans for the consumption of free hours in constructive activities. As I have tried to point out, those activities in which individuals can themselves participate with satisfaction rather than amusements are the ones that make for personal development and good citizenship. The "let alone" policy must be discarded for leisure as well as for industry. Municipal and county government agencies have already demonstrated their efficiency and inexpensiveness in administering broad and diversified activities on a democratic basis; supplemented by private agencies, they should be entrusted with larger responsibility and given adequate financial support by taxpayers and the moral backing of industry and labor.

# MANAGEMENT SHORTS



## One Girl, Four Machines By Photocell

The Rose Patch & Label Company, Grand Rapids, Mich., has adapted the photocell principle to the cutting of cloth labels of ribbon widths. Strips of starched cloth are printed with the label design which later becomes the namemark for a suit of clothes, towel, or blanket. Between the labels the printing presses stamp dark lines of ink crosswise on the strip of ribbon.

When these cross-strips pass before a photoelectric cell, they set up a disturbance which is amplified by a thyratron tube to operate a knife which cuts the ribbon into proper label lengths. Each label is cut exactly on the dark cross-strip by the knives. Sensitivity of the electric eye allows the printed matter of the label to pass, but cross-strips cause the cell to operate the knife.

Should a botched or badly printed label pass, the electric eye causes the entire label to be rejected. One girl can watch four machines with photocell control—used to take one girl for one machine.

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## Safety Follows the Flag

SOURCE, Robert A. Shaw, Director of Safety & Welfare
Murray Corporation of America, Detroit

How this concern stimulated a permanent clean-up drive which reduced accidents in the mother plant in Detroit and in five subsidiaries, is illustrated in the rating chart presented herewith.

Every month special committees in these plants inspect each division and rate it as indicated in the left-hand column of the chart. The deduction made for each violation varies with the size of the department. Naturally the painting department, being big, gets off easier for a single violation than the inspection department, which is small. It will be seen that the body-in-white department was the winning division for October. Although the inspectors found ten violations of good housekeeping, each rated only 0.16 per cent, so that the total deduction of 1.6 gave a high score of 98.4 per cent.

The winning division gets a flag which it flies for a month. Winning the flag twice in a row carries with it a substantial cash prize. The management has been surprised to note how this contest creates a personal desire on the part of each superintendent, foreman, and workman to pick up rubbish and put materials where they belong. The salvage department hasn't so much to do as it used to, and it has been noted that each winning of the flag is accompanied by an immediate reduction in accidents.

**GENERAL SAFE HOUSEKEEPING CONTEST** Date October 23,1933
**WINNING DIVISION FOR MONTH OF** Body in White October, 1933

| | J. Anderson Paint | A. Derse Bin W. | F. Cassel Trim | E. La Dow Press | J. Vehke Dies | R. Sheridan Insp. | L. Juhl Plan. | E. Tellefsen Maint. | O. Graebner Eng. | W. Berger Salv. | W. Mc Michael Plt. Pro. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage deduction per item | 0.3 | 0.16 | 0.4 | 0.6 | 10.0 | 8.0 | 0.2 | 1.3 | 1.0 | 2.5 | 1.3 |
| Aisles | | | 1 | | | | 1 | | | | |
| Stock | | 1 | | | | | | | | | |
| Refuse | 1 | | 1 | 1 | 1 | | 1 | | | | 1 |
| Personal hygiene | 1 | | 1 | 1 | | | 1 | | | | 1 |
| Sanitation | 1 | | | 1 | | | | | | | |
| General appearance | 1 | 5 | 2 | 2 | 1 | | 2 | | 2 | 1 | 1 |
| Industrial hygiene laws | | | | 1 | | | | | | 1 | |
| Waste | 1 | | 1 | 1 | | | 1 | | | 1 | |
| Property damage | | 3 | | | | 1 | 2 | 1 | | | |
| General carelessness | 2 | 1 | 3 | 1 | | 1 | 1 | 1 | 1 | 2 | 1 |
| Grand total for this month | 97.9 | 98.4 | 96.4 | 95.2 | 80.0 | 92.0 | 98.2 | 97.4 | 97.0 | 87.5 | 94.8 |
| Grand total for last month* | 96.7 | 96.2 | 94.8 | 96.4 | 90.0 | 92.0 | 98.2 | 96.8 | 98.0 | 97.5 | 96.1 |

Note: * September, 1933

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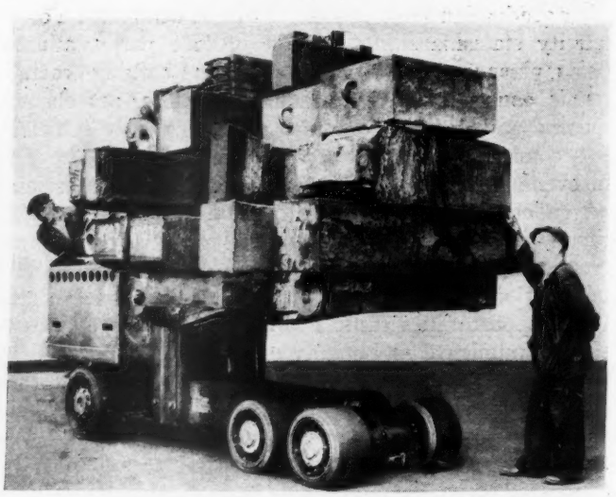

**Electric trucks are a big help in handling heavy dies in and out of storage. This one, especially designed to handle a 25-ton body die in a Detroit automobile plant, is getting an initial workout under a 28-ton load of ingots**

## Glue Detector

A Western supply company manufactures box ends from scrap lumber. In the process, certain pieces are glued and then pressed together after the lumber has been grooved. At one time it was practically impossible to detect the absence of glue after the grooved pieces had been pressed together. The company found that box ends that pulled apart through lack of glue were both expensive and annoying.

In solving the problem, the company installed a vacuum tube relay and arranged steel piano wire contacts to scrape in the grooves in such a manner that the circuit is completed through the film of glue. This circuit is connected to the grid of an amplifier tube mounted on a panel. This amplifier tube is so connected as to control a sensitive relay. As long as the circuit is closed through the glue, no action occurs, but as soon as the circuit is opened by the absence of glue the relay operates to ring a bell and light a lamp.

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## Can See What She's Doing

SOURCE, Westinghouse Electric & Manufacturing Company East Pittsburgh, Pa.

Now that the bench assembly set-up is no longer "anybody's job"—see page 160—maybe more attention will be paid to lighting. Too often it has been overlooked, perhaps completely overshadowed by the motion analyst's eagerness to arrange the circular workplace with its bins, fixtures, and shop delivery to suit the operator's best convenience. Obviously, the operator will do more work and better work if she "can see what she's doing." The time-study man in the photograph is making sure that she can by checking the intensity of the illumination with a foot-candle meter.

## Proving the Product

SOURCE, The B. F. Goodrich Company, Akron, Ohio

There is more than a slim chance that other plant executives can adapt to their own testing problems the principles made use of in the "tire guillotine." This machine is another of those devices developed by manufacturers to check product performance.

Tires were previously tested with a slow-speed machine which pushed a hammer nub into the tire carcass. This nub, operated on an adjustable eccentric, repeated the operation until the tire failed. Results were not consistent, however, because of the low speed at which the impact took place and the heat generated by the repetition of the strokes.

The new machine is so designed that a tire receives only one blow at any one point, standard inflation pressures are used, and the blows occur at speeds corresponding to those which initiate such impacts under actual service conditions.

The guillotine is housed in a 90-ft. shaft. A blunt-nosed metal hammer nub, sliding between rail guides, is dropped directly onto the tread of a tire inflated and mounted on an axle held in position at the bottom of the shaft. The weight of the hammer and the distance of the drop can be regulated at will—13-, 23-, and 33-lb. weights and 1- and 1½-in. hammer nubs provide a combination of impact values.

Impact tests are started from a minimum which will not cause failure from bruising. With each impact the height of hammer fall is increased and the tire rotated slightly. No one point on a tire carcass is given more than one blow. Failure is evidenced either by a peculiar sound of the impact, indicating that the tire cords have snapped, or by the raising of a lump on the tire suface.

Factory Management
*and* Maintenance

A consolidation of *Factory and Industrial Management* and *Maintenance Engineering*

L. C. MORROW, Editor

APRIL, 1934

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# *The Wagner Bill Should Not Pass*

IT IS OUR opinion that the "Labor Disputes Act,*" if passed, will adversely influence the immediate recovery program and postpone ultimate arrival at a condition of permanent industrial peace.

This statement, and those that follow, are made after consideration of the bill as originally presented. Since presentation, the terms of settlement of the labor controversy in the automobile industry and the statement of the President issued in connection with the publication of those terms have given rise to hopes that the bill will be materially altered or abandoned. However, it should not be assumed that either action will follow as a matter of course. We therefore consider it advisable for industries and individuals to watch developments carefully and make their opinions known to Washington.

The bill virtually establishes a labor dictatorship:

By imposing severe restrictions upon employers, none upon labor.

By giving a striker legal standing as an employee, denying such standing to a person replacing a striker.

By legalizing the closed shop.

By setting up a Labor Board with unnecessarily broad powers.

By setting up restrictions that practically preclude the operation of all but the American Federation of Labor type of employee representation.

Let us consider these several provisions of the Act, as they are set forth in the Wagner bill:

Section 303 provides that *"Nothing in this Act shall be construed so as to interfere with or impede or diminish in any way the right to strike."* On account of the restrictions that the bill places upon employers, this unqualified provision should not stand. It takes no account of injustices, suffering, and loss of life that can be brought to great numbers of people by strikes in public service industries. Moreover, legislation should look toward bringing into effect the kinds of industrial relations that will prevent strikes, which are costly affairs, no matter how well justified.

Section 5 provides that *"It shall be an unfair labor practice for an employer . . .* (1) *To attempt, by interference, influence, restraint, favor, coercion, or lock-out, or by any other means, to impair the right of employees guaranteed in Section 4".* Section 4 says *"Employees shall have the right to organize and join labor organizations, and to engage in concerted activities, either in labor organizations or otherwise, for the purpose of organizing and bargaining collectively through representatives of their own choosing or for other purposes of mutual aid or protection."*

If labor is to have the strike weapon, if labor organizers are to be permitted to advance one side of the argument, it seems a bit one-sided if employers may do nothing. This provision is in keeping with the remainder of the bill which places the employer always on the defensive.

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That strikers would still be considered employees is provided by paragraph 3, Section 3: *"The term 'employee' means any individual employed by an employer .....or any individual formerly so employed whose work has ceased as a consequence of, or in connection with, any current labor dispute or because of any unfair labor practice: Provided, That the term 'employee' shall not include an individual who has replaced a striking employee....."* It is our opinion that some strikes are likely to be so unjustified, some demands so unreasonable, that this provision would work great injustice. Whether strikers or replacements should have standing as employees appears to be a matter that might well be decided upon the merits of the individual case.

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One of the provisions that seems entirely out of accord with the spirit of the NIRA is that legalizing the closed shop, as set forth in paragraph 6, under Section 5, in which unfair practice is defined: *"Provided further, That nothing in this Act shall preclude an employer and a labor organization from agreeing that a person seeking employment shall be required, as a condition of employment, to join such labor organization, if no attempt is made to influence such labor organization by any unfair labor practice, if such labor organization is composed of at least a majority of such employers' employees, and if the said agreement does not cover a period in excess of one year."*

Sanctioning the requirement that an employee must join a union in order to work in a specific plant is not permitting the exercise of individual choice, opens the door toward coercion, intimidation, and forced contributions from employees.

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Much could be said about the dictatorial powers of the Labor Board which the bill proposes to set up. It should be enough to cite some of the features of the proposed legislation that seem extreme.

From the bill we find that any member of the Board (or its designee), *"from information acquired from any source whatsoever, that any person has engaged in or is engaging in any such unfair labor practice,"* may call that person for a hearing. Also, the Board, upon the

*Senate Bill 2926, introduced by Senator Wagner, pending before the Committee on Education and Labor. House Bill 8423, introduced by Congressman Connery, pending before the House Committee on Labor. The Connery Bill makes criminal the "unfair labor practices" that are made illegal by the Wagner Bill. Otherwise the two bills are the same.

testimony taken, may issue an order requiring the person who is the subject of the complaint *"to cease and desist from such unfair labor practice, or to take affirmative action, or to pay damages, or to reinstate employees . . ."* Also, in case of dispute as to who are the representatives of employees, the Board has the right of deciding. We find that *"The Board is empowered to prevent any person from engaging in any unfair labor practice that burdens or affects commerce or obstructs the free flow of commerce, or has led or tends to lead to a labor dispute that might burden or affect commerce or obstruct the free flow of commerce."*

These powers it is proposed to give to a relatively small group of appointed men. They portend certain uncertainty in industrial relations.

The bill does not require that the members to be appointed be qualified in any particular.

There is nothing in the bill to regulate the actions of labor, there are no specifications as to unfair practice by labor, and therefore the Board apparently has the one-sided function of regulating employers.

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We come now to the provisions concerning that type of employee representation which has come to be known since passage of the Recovery Act as "company unions." It is true that the Labor Disputes Act does not use the term, and that Senator Wagner, proponent of the Act, now uses the term "employer-dominated union." Yet the provisions of the Act, in our opinion, are such as to make inoperative all of the plans now in use. They are set forth in Section 5:

*"It shall be an unfair practice for an employer . . . (3) To initiate, participate in, supervise, or influence the formation, constitution, bylaws, other governing rules, operations, policies, or elections of any labor organization. (4) To contribute financial or other material support to any labor organization, by compensating any one for services performed in behalf of any labor organization, or by any other means whatsoever."* (Section 3 defines the term "labor organization" as meaning *"any organization, labor union, association, corporation, or society of any kind in which employees participate to any degree whatsoever, which exists for the purpose, in whole or in part, of dealing with employers concerning grievances, labor disputes, wages, or hours of employment."*

Many of the employee representation plans have been initiated by employers, even to the extent of writing the constitution, bylaws, rules, etc. And properly so. It has always been a part of management's job to concern itself with employer-employee relations. After all, it is what the plan says, not who wrote it, that counts. The plans in detail have been submitted to the employees for their acceptance or rejection, and where they are in operation the employees have accepted them.

In the operation of most of the plans, employee representatives are paid for the time consumed in attending meetings and in looking after related duties. Not all of the time of representatives, by any means, is devoted to the discussion of hours and wages. In any cooperative plan such payments are a part of plant operating expense and should not be charged to employees. The records of successful operation of plans show that representatives are not ineffectual because they are paid. Obviously a regulation that they could not be paid would tend to bring about a condition of parity with union procedure, would eliminate a worth-while advantage of employee representation plans.

It is true that many of the older plans, adopted about 1919, permitted what today seems to us to be too much domination by employers. It is a safe hypothesis that a considerable proportion of all plans were adopted as counter-offensives against unionization. But these are matters of unimportance if today the plans do give employees machinery by which they can bargain as to wages, working conditions, and employer-employee relations as a whole—that is, if they now operate upon a basis of community interest within a business enterprise.

Employee representation, as exemplified by the "Works Council," offers a most promising means of obtaining lasting industrial peace. Because it is founded upon a basis of community interest it has an advantage over unionism, which originated and is largely continued upon a basis of conflict of interest between workers and management. The Works Council type of representation should be encouraged, not destroyed.

This is not to say that unionism, either, should be destroyed. Unionism has served a good purpose, is still very much needed in some industries, will have a natural place in the social set-up. But it is objectionable as the *only* means of collective bargaining. Some of its practices handicap efficient plant operation.

That unionism should be only one of the kinds of machinery for collective bargaining is indicated by the enlistment of only 10 per cent of the gainfully employed workers during the period of greatest membership prior to the NIRA. Obviously other plans have been preferable and have proved satisfactory; witness declining labor trouble and increasing wages.

There is an intimacy about the Works Council operation, even in large plants, that is conducive to harmony. Disputes can be settled in the department in which they originate. Failing that, they can be carried up step by step until, with some plans, arbitration is made use of. In the process, management and workers always sit down together for a discussion of their differences. Each side has its eyes opened to the problems of the other. There is a mutuality of interest, without the necessity of becoming involved with outside interests, and without the risk of being called to cease operation because of a struggle elsewhere.

It has seemed to us that the Recovery Act gave a new impetus to amicable, common-sense employer-employee relations as they could be carried out by this type of employee representation plan. We know that much educational work has been done by men well informed as to employee representation plans, with the objective of preventing the adoption of unfair procedure. We believe that many plans are not all they should be, but we also believe that faulty plans should be corrected; that legislation should look toward making them workable; that imperfection in some constitutes no justification for abolishing good and bad alike.

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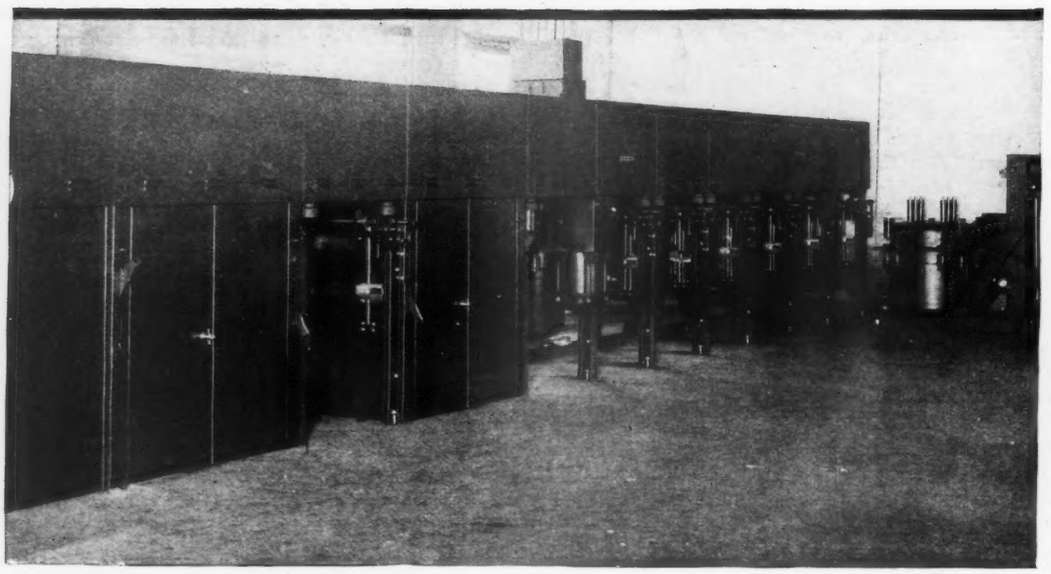
We can only conclude that the Labor Disputes Act, as constituted, should not pass; that its very proposal has been a further retardation to recovery because of the uncertainty it has fostered on the part of both labor and employers; and that its passage would seriously delay reaching a condition of sound understanding between the two great forces of production, workers and employers.



These are the feeders and disconnecting switch units of a metal-clad switchgear installation for 11,000-volt service. One of the removable breaker units can be seen on the transfer truck at the right

# Safety Says: Inclosed

## *Housing for switching equipment protects gear, operators, maintenance men*

SWITCHGEAR in an industrial plant is a very important part of the plant equipment because uninterrupted production, often the quality of the product, depends upon the efficiency of the control and the continuity of the supply of electrical energy for driving the machinery.

To meet the requirements industrial switchgear should, therefore, have these features: ease and economy of installation; compact construction so as to occupy small floor space and headroom; low maintenance cost to keep equipment in good operating condition; adequate protection to control apparatus and operators, with easy access to parts requiring occasional inspection or adjustment; thorough insulation with adequate safety factor; protection from dust and dirt; and durability and reliability of all component parts. What the general methods of accomplishing these ends are and the manner in which they are applied to the various types of modern industrial switchgear, will be discussed in this article.

Ease of installation is for obvious reasons of particular interest to the industrial plant. It is accomplished primarily by shipping equipments from the factory in completely assembled units, and in groups of units assembled as far as transportation and handling facilities permit.

Constant effort is necessary to reduce space requirements with no sacrifice in insulation protection between live parts and to ground, and with no crowding of parts that would make access difficult. Of particular assistance in this program, especially on a.c. inclosed equipments, have been the improvements in circuit breakers, resulting in great reduction in size for a given interrupting rating.

Dressing of contacts of air and oil circuit breakers, changing and reconditioning the oil, cleaning at regular intervals, and inspection and upkeep of insulation require the attention of the maintenance department if an equipment is to function satisfactorily. The problem is to keep the maintenance attention required to a minimum, and in modern switchgear this requirement has been given much study.

Copper contacts of circuit breakers are bound to oxidize and although they can be kept in good condition by occasional opening and closing of the breaker, it is not always possible or convenient to do so; hence some reconditioning is eventually necessary. For this reason the main current-carrying contacts in many of the modern, larger capacity air and oil circuit breakers are silver-surfaced. Such contact surfaces will become oxidized, but the oxide of silver is practically as good a conductor as silver itself; therefore, cumulative heating no longer occurs and reconditioning is necessary only at long intervals. Silver contacts are also employed on many disconnecting switches and similar devices.

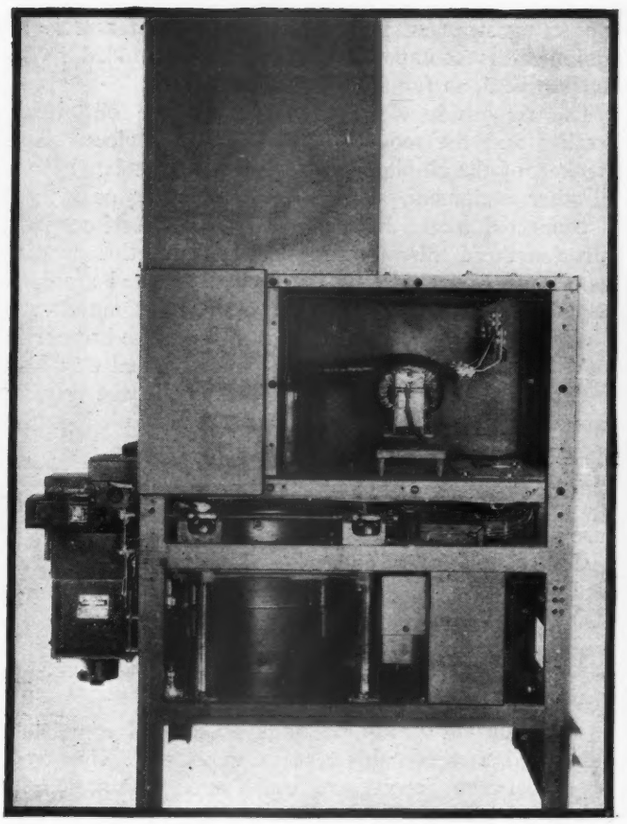
Protection to apparatus and safety to operators is afforded by metal-inclosed equipments to a degree not possible with some of the less modern constructions. A variety of such inclosed apparatus is available, affording the degree of protection economically justified in a par-

ticular case. Cubicles, metal-clad switchgear, steel-cell oil circuit breakers, oil circuit breaker trucks, truck panels, and inclosed air circuit breaker boards give a selection to fit every condition. Such inclosures, besides protecting apparatus and operators, also exclude vermin and protect the equipment from dust and dirt.

The most troublesome of all defects is poor insulation. In modern industrial equipment this feature is given careful attention. Buses are commonly spaced so that bare conductors may be used, although in metal-clad switchgear they are covered with a molded insulation because it is desirable to have an especially high factor of safety. Connections from oil circuit breakers to current transformers, disconnecting switches, and buses should be insulated for full voltage, as an additional safety factor. With inclosed equipments, which are universally shipped assembled, this insulation is usually applied at the factory, but on open equipments and where apparatus is disassembled for shipment the insulation can best be put on during installation.

With this explanation of how the desirable features of industrial switchgear are obtained, it will be in order to describe the various types of equipments available.

Basically, a switchgear cubicle consists of an indoor equipment with each circuit in a unit inclosure, usually

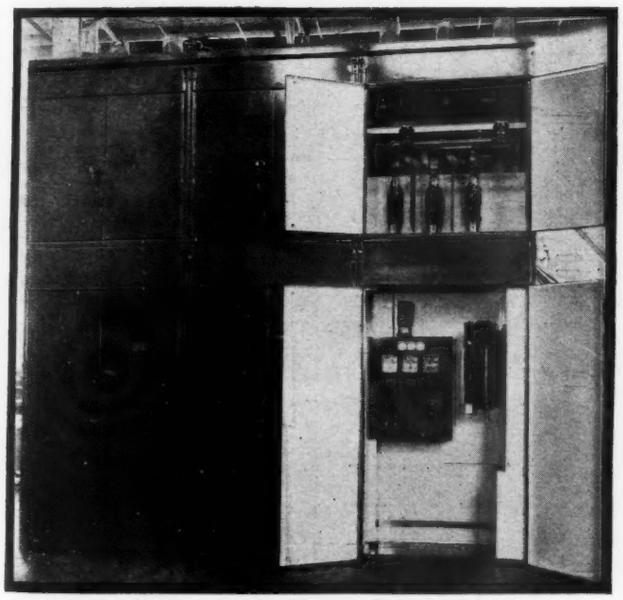


End view of a metal-clad equipment for 15,000 volts. The end plate has been removed to show the current transformer compartment. Potential transformers are in the upper compartment

# Switchgear

*E. H. Beckert*

*Switchgear Division, General Electric Company*
*Philadelphia, Pa.*



An outdoor switch-house for 13,200-volt service. It comprises an assembly of three units with superstructure containing hook-operated disconnecting swtches

of metal, on back, sides, and top. Units may be assembled together to form a complete control. The main switching devices and associated equipment such as instrument transformers, disconnecting switches, and connections, are mounted inside; the control, meter, and protective devices are on the front. The main switching device, usually an oil circuit breaker, is bolted to supports and may be manually or electrically operated. Leads enter from below. Access is obtained through removable plates at the rear.

To this basic structure refinements may be added as desired. Entrance may be through hinged doors instead of removable plates, either front or rear, or both. Barriers between the primary and secondary equipment are optional. They may also be placed between the bus or the oil circuit breaker and disconnecting switches. Interlocks can be provided between group-operated switches and oil circuit breakers so that the circuit can never be closed or opened by the disconnecting switches. They can also be furnished between the rear door of the cubicle and the disconnecting switches so that the door cannot be opened unless the switches are open. Cubicles are shipped completely assembled and require no special foundations.

In metal-clad switchgear the main switching unit is easily removable, instead of being bolted to its supports. Each unit is composed of a stationary structure and a removable switching element. On the stationary structure are mounted disconnecting devices and selector dis-

connecting switches, if any. Each group of associated equipment is contained in a separate, grounded metal compartment, so far as practical.

The removable element consists of the oil circuit breaker and the movable disconnecting devices. The breaker, of the oil-blast type, is effectively isolated from all other equipment. When in the operating position it is connected to the bus and line through self-coupled, silver-surfaced, disconnecting devices. Stationary disconnecting devices are of the socket type and are connected to the buses, whereas the movable disconnects are formed at the tips of the breaker studs. The breaker is moved vertically into contact by an individual elevating mechanism. Interlocks are provided so that the breaker cannot be moved into or out of contact unless it is in the open position, thus preventing the making or breaking of circuit current on the disconnecting devices. When the breaker is lowered it may be moved from the structure by means of a transfer truck.

Control, metering, and protective devices for metal-clad switchgear may be mounted on a separate control board, or on stationary or hinged panels attached to the units. If desired, a weatherproof housing may be provided for metal-clad gear to make it suitable for outdoor installation.

Each unit or group of units is shipped completely assembled and contains a continuous bus; splices in buses between groups are made upon installation by means of bolted, silver-surfaced splice plates. Insulation of the splices consists of molded insulating blocks filled with compound.

The metal inclosures exclude dirt and dust, thus reducing maintenance attention required, and at the same time give protection to the apparatus and to the operators.

### For Inspection or Reconditioning

Accessibility to parts requiring occasional inspection or reconditioning is provided by the removable oil circuit breaker, which can be lowered and removed. Bus and current transformer compartments are made with overlapping, removable sheet-steel covers. Access to the potential transformer compartment is obtained by the removal of the front steel plate.

Although they give less protection to operators and apparatus than is provided by inclosed equipments, factory-assembled, open-switching structures have numerous applications in industrial plants. Built of a rigid framework for mounting oil circuit breakers and accessory equipment, they are shipped assembled in groups of as many units as can conveniently be handled and thus offer the advantage of easy installation. The compact but open construction permits easy access to parts requiring occasional attention.

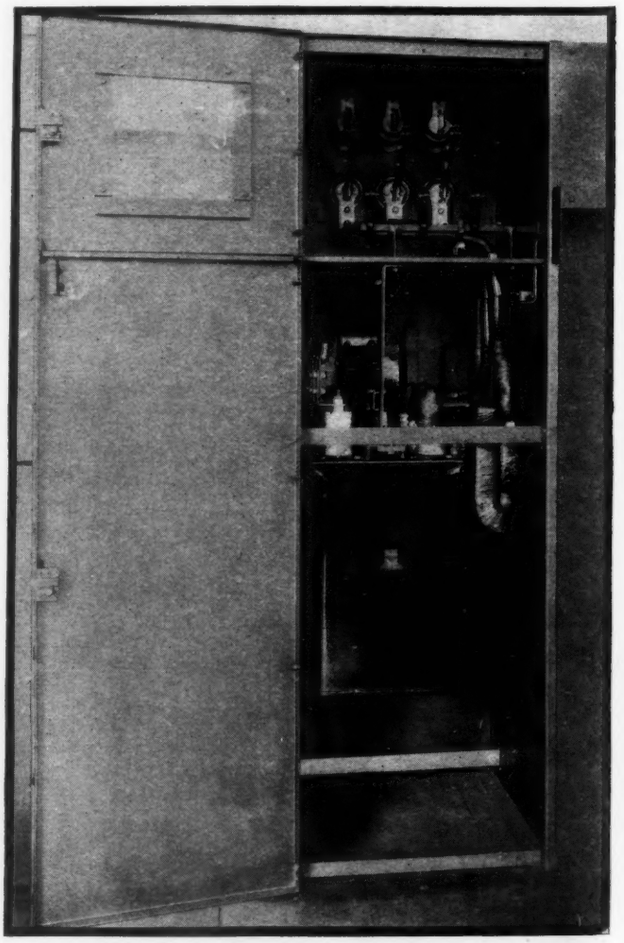
The inclosed air circuit breaker board, another structure that is shipped assembled, finds industrial application for the control of 600-volt and lower distribution circuits.

Each breaker, mounted on an ebony asbestos base, is individually inclosed, a removable flanged plate giving access to the breaker compartment from the front of the board. The breaker operating handle passes through this plate. Breaker studs extend through the asbestos base which forms the back of the breaker compartment. Buses and connections are mounted in the rear of this structure and removable metal sheets on the top, sides and back, along with the switchboard front, form a complete inclosure that houses the buses and connections as well as the breakers. A pull box is mounted at the top of the structure for incoming and outgoing cables.

Another form of air circuit breaker board utilizes the compound inclosed breaker which has recently become popular for panelboards, load centers, and distribution boards. These breakers are mounted back of the panel-front with handles extending through. The panel front is easily removable to give access to the breaker and permit removal from the front. Since the breaker is inherently inclosed, no separate compartments are needed. Buses and connections are mounted in the rear, and removable plates on top, sides and back may be used to form a complete inclosure.

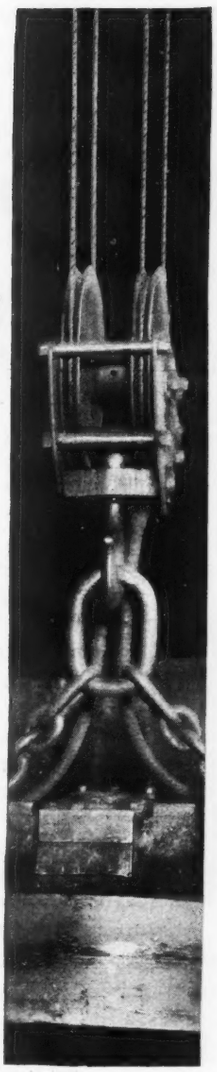
Outdoor equipments offer important advantages and have been particularly useful for the control and protection of incoming lines and transformers. With these equipments fuses, disconnecting switches, and accessory devices, which may include high-tension oil circuit breakers and lightning arresters, are usually mounted on steel structures. Different types of disconnecting switches are available to fit various conditions and all commercial voltages. Reliable fuses of sufficient inter-

*(Continued on advertising page 46)*



**Feeder cubicle for 2,300-volt service. This is a rear view, showing the breaker and group-operated disconnecting switches. A system of interlocks, such as described in the text, is used between the breaker and disconnecting switches in this installation**

# Wire Rope *Selection and Maintenance*



*Fred D. Hartford*

*Denver, Colo.*

THE CHIEF draftsman's telephone rang. The plant master mechanic was calling. "Jack and Sam have more than they can handle. Send Hartford out and we'll teach him something about maintenance."

In the bright lexicon of youth there is no such word as fail. Nor is these anything about wire rope. My first job, with the aid of a couple of "huskies," was to put a new cable onto the drum of a derrick hoist. A flat coil of shiny, new wire rope lay in front of the hoist. I assumed that wire rope behaves like manila rope, spent the most strenuous fifteen minutes of my life trying to coax that wire rope onto the drum. It just can't be done that way. Fortunately the master mechanic came around and explained that, if the coil were rolled along the ground like a hoop, the rope would unwind straight and then could easily be run onto the hoist.

A lot of wire rope has been spoiled by the kinking and untwisting that invariably follows an attempt to *force* wire rope to act like hemp. Where severe twisting action on wire rope cannot be avoided, the use of freely-rotating swivel hooks or eyes is advisable.

The maintenance engineer, in order to make his wire-rope dollar go the limit, has before him two considerations: first, routine maintenance; second, selection of the best new rope for replacement.

A fundamental requirement of wire-rope maintenance is keeping the rope as clean as possible. Wear is caused by grit between the rope and the sheaves or among the interior wires. To aid in keeping a rope clean, plenty of rope rollers, curve sheaves, and wooden blocks should be provided to prevent contact with the ground. To minimize internal wear, the liberal saturation of *new* rope with the proper compound is essential. Wire rope in service should be thoroughly cleaned and dried before lubricant is applied; otherwise grit and water held within the rope by the lubricant may do serious damage.

Since an ordinary wire rope has a relatively large surface area of metal, all lubricants used should be non-corrosive. If the rope is used under water, special attention should be given the lubricant since the latter may be decomposed by the water, forming corrosive byproducts. If wire rope is to be stored for any length of time, a heavy coat of petrolatum will prevent further rusting.

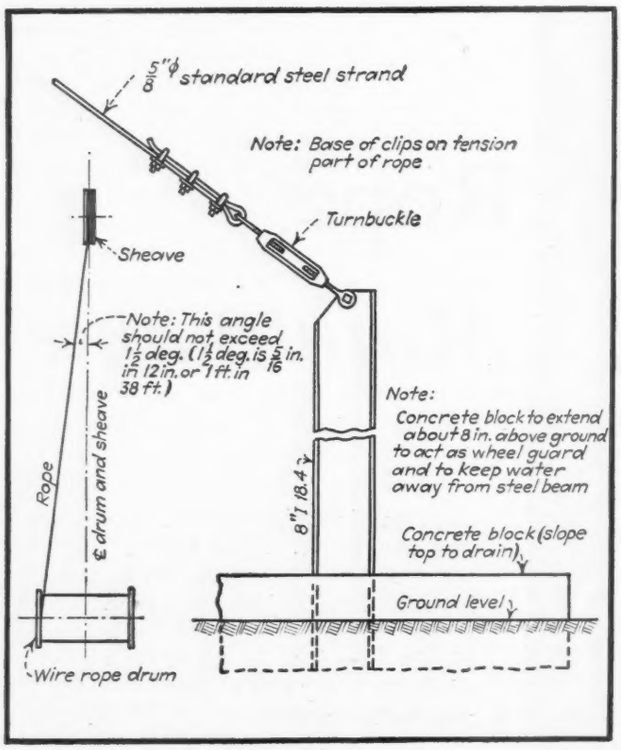
### New Wire Rope

When ordering new wire rope, the maintenance engineer has two vitally important things to consider: First, "How resistant to wear must the rope be?" Second, "How flexible must the rope be?"

For intermittent hoisting, for freight elevators, and for derricks, where the rope rusts out about as rapidly as it wears out, cast-steel rope will be found generally satisfactory. If the service requires that the rope be dragged along the ground or through sand and water, then one of the plow-steel grades should receive favorable consideration.

It should be realized that, strength for strength, ropes of higher quality steel, being smaller than those of the ordinary grade, actually cost but very little more. And since they are smaller in diameter, they are relatively more flexible. For electric cranes, or wherever great reserve strength is desirable, and where the rope will be subjected to jerks, the special plow-steel grade should always be specified.

Flexibility in a wire rope is achieved at the expense of wear resistance and strength since the flexible ropes are made of finer wires than those in the standard hoisting ropes. However, flexibility is such a desirable characteristic, especially where small sheaves and drums or manual handling are necessary, that loss of strength is usually a minor consideration. For example, a ½-in., 6-strand, 37-wire special flexible cast-steel hoisting rope is good for 2,900 pounds working load, whereas the 6-strand, 19-wire standard hoisting rope of the same material and size is good for only 450 pounds more. When added carrying capacity is necessary, it is frequently better to buy a higher grade of rope rather than sacrifice flexibility. Thus, a ½-in. special flexible rope in the extra-strong cast-steel grade is good for 3,300


5/8" ϕ standard steel strand
Note: Base of clips on tension part of rope
Turnbuckle
Sheave
Note: This angle should not exceed 1½ deg. (1½ deg. is 5/16 in. in 12 in. or 1 ft. in 38 ft.)
Note: Concrete block to extend about 8 in. above ground to act as wheel guard and to keep water away from steel beam
℄ drum and sheave
Rope
8"I 18.4
Concrete block (slope top to drain)
Ground level
Wire rope drum

**In leading a wire rope from sheave to drum too great an angle will cause metal fatigue and wear. Guy posts may be set in concrete blocks as shown and wire guys fastened in the manner indicated**

pounds working load and costs but 2 cents more per foot than the 2,900-lb. rope.

The use of wire rope over sheaves or drums smaller than those recommended by the rope manufacturers reduces its life, especially if the rope travels at high speed. For service where men must drag or handle the rope, and for slings, the special flexible rope is desirable.

### Standing Ropes

What has been stated previously applies to "running" ropes on cranes, car pullers, hoists, elevators, and the like. However, many of the wire ropes around the industrial plant are "standing" ropes which, once placed, are not subjected to continual bending or to wear. Stack and derrick guys, messenger cables, pole guys, suspension bridges, and fences are typical of this use. Obviously, the only flexibility needed for these ropes is to facilitate their erection and bending around thimbles.

This necessary flexibility of standing ropes is obtained with the 6-strand, 7-wire type, the so-called transmission or haulage ropes. The most economical grade of this rope is the "cast steel," which can be purchased galvanized to provide "built-in" resistance to weather and corrosion. Another rope for guying purposes is made of a single strand of 7 or 19 wires, all of the same size, and termed "standard steel strand." This rope is always galvanized or double galvanized.

Ungalvanized standing ropes should be painted, not treated with greases. A good method of painting derrick or stack guys is for the painter to straddle the wire and then propel or brake himself along by holding around the rope with his hands a burlap sack saturated with paint. Since the cost of painting guys is relatively high, a good grade of paint should always be used so that the interval between paintings is as long as possible.

### Tiller Ropes

While master mechanic of a sulphuric acid plant where considerable painting was done from boatswain's chairs, I found that new manila rope was necessary on each painting job. Sulphuric acid may weapen manila rope without changing its outer appearance. Painters naturally became wary of any but new ropes on lofty jobs. The solution to this particular problem was $\frac{5}{16}$-in. tiller rope saturated with petrolatum. Tiller rope is made of 6 small ropes, each of which is formed of 6 strands of 7 wires each, 252 wires in all. It is extremely flexible but, due to the fine wires composing it, has little resistance to wear. It must be carefully coiled, preferably on a reel, to prevent snarling. Tiller rope is also best for freight elevator controls, signals, and remote operation of electrical and transmission controls.

### Replacements

When the purchase of a new wire rope becomes necessary, the maintenance engineer should carefully examine the worn rope, check the sizes and conditions of the sheaves and drums, make an accurate measurement of the length, and tentatively decide what rope is best. As a check on his decision he should call in representatives of manufacturers. Ordinary standard and flexible hoisting ropes will answer most needs. Other ropes are made for special conditions and can be had on short notice. Among these special ropes are Lang lay, steel-clad, marlin-clad, non-spinning, flattened strand, bridge rope, arc-light, flat rope, airplane strand, and many others.

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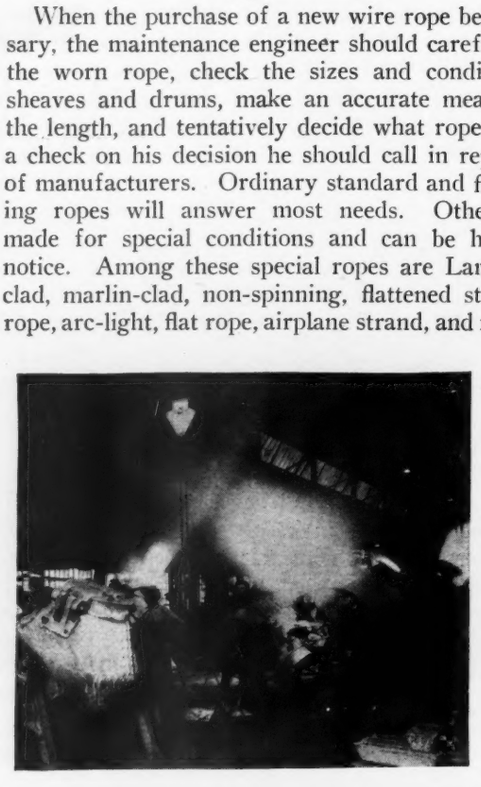
OPERATING *under codes makes accurate costs more important than ever. But how to get them on work of a jobbing nature? G. J. Stegemerten, co-author of "Time and Motion Study and Formulas for Wage Incentives," shows how in a May article—and incidentally proves that formulas are neither mysterious nor academic, but intensely practical costing tools*



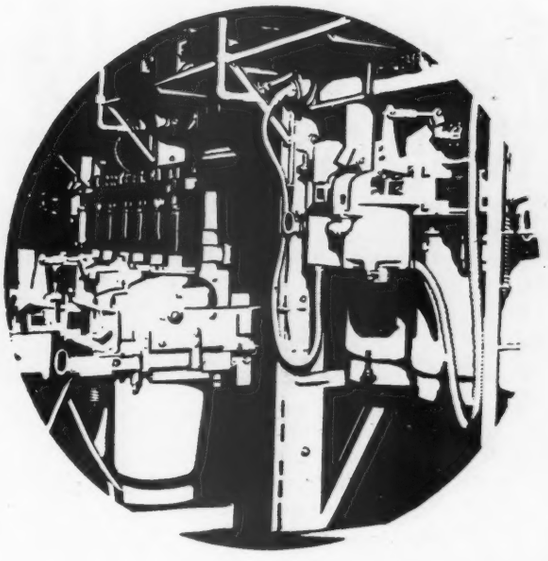
# *Forget Price*

# When You Buy Circuit Breakers

## A few dollars saved may mean wrecking the apparatus you intended to protect

*William G. Merowit*

*Wm. G. Merowit Company*
*Buffalo, N. Y.*



CONTRARY to the general impression, the chief function of protective circuit breakers is not to open the circuit but to keep it closed, except when opening is absolutely necessary in order to prevent immediate destruction of the equipment back of the breaker.

This is an important point. The fallacy that the function of a protective device is to open the circuit on any and all occasions is the basis of improper design and poor operation. If electrical apparatus were designed to stand heavy overloads and short circuits, the protector would not be necessary. It is needed only because the great amount of energy which must be handled will produce disastrous results on short circuits or under other abnormal conditions.

All protective apparatus, such as automatic oil switches and air circuit breakers, are used (*a*) between a generator and its load; (*b*) between the transformer and the generator on a.c. systems; or (*c*) between the transformer and the load. This fact must be considered in selecting the proper protective devices and accounting for their action. The choice must take into account the characteristics of all the classes of apparatus which affect it and which it in turn affects. For example, a circuit breaker selected for a motor circuit is not only affected by the size and characteristics of the motor, but also by the size of the generating plant back of it. This means that a circuit breaker suitable for use with a 5-hp. motor on a line fed by a 1,000-hp. plant may not be suitable for use with the same motor in a much larger plant where considerable energy may be pumped into it on short circuit. This fact makes for various designs of protective devices and renders it necessary to give the manufacturers full information regarding the conditions, before the proper one can be recommended.

### No System Better Than Its Protective Devices

Since the protective device is the link between the various classes of apparatus for generating, transforming, utilizing, and controlling electrical energy it follows that the successful operation of the system depends on the operation of its protective devices. After the general system of protection has been determined, it is necessary to have apparatus with details carefully worked out.

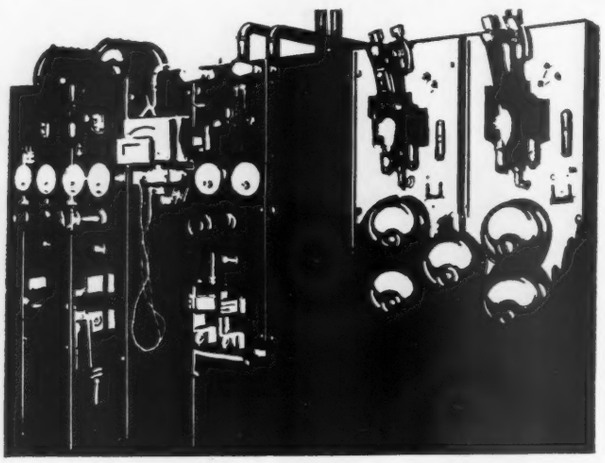
Every circuit breaker must carry the current of the apparatus which it protects, whether it be a $\frac{1}{2}$-hp. motor or a 15,000-kva. generator. It is always used in series with the apparatus it protects and has to carry the same current. All circuit-protecting devices, therefore, must be designed with reference to their continuous, current-carrying capacities.

In this respect distinction should be made between protective devices and starting devices, since starting devices are used only intermittently or during the starting period and hence are called upon to carry the current passing through them for only a short time. Circuit-breaking and current-carrying contacts that have been found to be satisfactory for starting apparatus, are not always satisfactory for circuit-protective apparatus. Failure of more than one class of circuit-protective apparatus can be traced to the fact that an attempt was made to use controller contacts in them.

For carrying current continuously there is nothing more satisfactory in the way of a joint than a well-soldered one; next to that comes a heavily bolted joint; a laminated joint is a close third. They are followed by

blade contacts, clip contacts, butt contacts, and so on, in the order of their efficiency as current-carrying members. Bolted and soldered joints are obviously impracticable on switching or circuit-breaking devices. However, the laminated brush is able to make and maintain a good contact and can be easily removed from the contact to open the circuit. When correctly made and used, it is, I think, the best current-carrying member employed for either air or oil breakers. In fact, its use has become universal on carbon break, air circuit breakers, and there is no reason why its use should not become just as universal in oil switches.

Whatever kind of contact is used, the purchaser of oil switches should insist that the contacts be of sufficient



carrying capacity to handle the full-load rating of the switch with a rise not exceeding 30 degrees Centigrade. A higher rise is dangerous not only because it limits the overload capacity, but because it heats the oil. Heated oil is not so effective as cool oil in quenching an arc.

The importance of the contacts on oil switches is emphasized because they are inclosed by the oil tank which has considerable radiating capacity, and the oil itself is a good heat-carrying medium. Oil switches have sometimes been provided with contacts that were not adequate for their rated service.

### Contacts

Oil should not be depended upon to take care of poor contacts. The contacts in oil switches should be as capable of carrying full-load current without overheating the oil as a similar contact on an air break switch. It is poor policy and shortsighted buying to purchase for 200-amp. service, say, a switch that would be rated at 100 amperes in air, but when put in oil is rated 200 amperes, because of the heat-conducting oil and tank.

Under the head of current-carrying parts also come such details as proper terminal connections, proper-sized studs, and so on. Purchasers should specify both the rise at the contacts and the rise at the terminals, so that a poor or inefficient contact with a large temperature rise will not be masked by heavy terminals.

Besides ample current-carrying capacity, a circuit breaker must have a device that will satisfactorily interrupt the energy which may be put through it.

Much could be written about the methods of opening electric circuits without destroying the opening device. The subject is still open to much research. Various theories have been propounded and the prospective purchaser is likely to be confused by the various claims of different manufacturers. A few fundamental rules can be laid down, however, which should serve as a guide in selecting the proper circuit breaker, considered as a device for breaking the current only and not for carrying it.

With carbon break, air circuit breakers for direct current it seems to have been proved that if the carbons are of ample size, if their resistance is low at the instant of break (not when the breaker is closed), and if the break is wide enough, such a breaker when properly mounted will satisfactorily open any short circuit that may be put upon it.

When an oil switch is used on high-tension a.c. systems where there is a great amount of energy back of the switch, the problem of interrupting the circuit becomes more difficult. Cases of oil switches blowing up are well known. Other things being equal, the oil switch that has the strongest mechanical structure, the strongest oil tank, and the greatest head of oil over the break at the instant of opening, will handle the most energy. These are points that can easily be determined by an inspection of the switch. If the oil tank is weak, either integrally or in the method of fastening it to the main frame, or if the break starts too near the surface of the oil, no matter how deeply it is pulled into the oil afterwards, the rupturing capacity is greatly reduced.

### Penny-Pinching Is False Economy

In general, the best test is the test of service. If switches have been used satisfactorily for years on systems with large capacity back of them, this fact should be given due weight.

Nowhere is penny-pinching such false economy as when applied to the purchase of protective devices. There are differences in the design of protective apparatus and it will pay in the long run for the purchaser to spend a little time going over a manufacturer's product with his representative before making a decision, and not depend entirely on his ability to digest current bulletins. With no other class of apparatus should price be given so little consideration. The price of even the best and most expensive of these devices is almost nothing compared to the cost of the equipment which they protect. Saving a few dollars on protective devices may result in wrecking the apparatus they are supposed to safeguard.

**A bottle case manufacturer makes 40,000 wooden cases a month, finds special production machinery will cut unit costs, nearly double his capacity. He buys it. Almost immediately the bottle case business gets good. He discovers he can sell 100,000 cases a month. Should he buy a second complete special-purpose unit? Or what? A May article tells**

# Getting Costs—and Keeping Control—of Maintenance

*Carl G. Wyder*
*Planning Engineer*
*Textile Dyeing & Printing Company of America, Inc.*
*Fair Lawn, N. J.*

**Initiation of order, following it through the shop, building up the costing information, getting ready for cost analysis**

THE INITIATION of an order for maintenance work is enacted in a formal written *Request to Engineering Department*, Figure 2. This request is the origin of all work desired, and, in accordance with the principle just stated, it is executed either by the engineering department or an operating department. In the technique of this request lies the fulfillment of the entire shop order system; consequently its value, notwithstanding its simplicity, cannot be over-emphasized.

Please note particularly the manner of approval of the request, which extends the use of the form to a request for an estimate by either the requestor or the executive solicited for approval, and at the same time provides for the identification and security of responsibility when an estimate is first desired.

Request forms are furnished in a linen-bound, pressboard covered book, containing 50 consecutively numbered white original and yellow duplicate copies, and distributed to all plant executives and foremen. These men may enter more than one subject on a single form, a feature especially helpful to the engineering department executives in jotting down incidental observations of work to be done. The white perforated copy is torn out and forwarded to the engineering office, while the yellow-bound copy serves as a reference record. The white copy is checked by the clerk in the engineering office for proper approvals, and specific instructions are obtained from the plant engineer for the wording of the formal order which follows. After complete order reference notations have been made where indicated, the request is filed numerically in the engineering office.

### Shop Order and Shop Sub-Order

The formal order to the engineering staff is issued by the clerk on one of two forms, the *Shop Order* form or the *Shop Sub-Order* form, Figures 3a and 3b. The choice depends only upon whether or not the particular assignment requires complete detailed material costs in addition to the labor costs. In the evolution of this system the fact has been recognized that there are many jobs for which the results of gathering detailed material costs do not justify the effort. There is in this adaptation, moreover, no relinquishment of material control, because the plant engineer must approve all purchase requisitions for engineering material. This distinction in actual practice has curtailed clerical effort in material costing by the issue of twice as many shop sub-orders as shop orders.

The two forms are identical in design and application in all but a few major respects, and their execution is self-explanatory. The shop order and the shop sub-order are furnished in contrasting buff and pink colors, respectively, and consist of two copies, the original of bond, and the duplicate of index card quality.

### Numbering Is Important

The technique of numbering these forms is considered the heart of the entire order system, and only a careful study of, and familiarity with, the procedure will enable the reader to understand the mechanics of cost data accumulation to be described later. Both types of forms are numbered alike, excepting that the shop order number is preceded by a *K* (already printed on the form) to identify it as a material costing order.

The order number proper is composed of four parts, a numeral, followed by the letter *N* or *R*, then another numeral, concluded by one of six letters, *A* to *F*. The first numeral identifies the order itself from all other orders, and is assigned in sequence from a numerical record book in which the date and request number are entered. The second letter indicates whether the work involves capital expenditures in new work or alterations (*N*), or repair or replacement expense (*R*). The third number indicates the operating department in which the work is being done, for which a very helpful cross-reference record book with a departmental index is maintained for entry of the date, order number, and title. The fourth and concluding letter signifies the engineering division (as shown in the organization chart) which is performing the work. The complete

Part I, describing the plant in which this system is in operation, and setting forth the principles upon which the system is based, was published in the March issue.

TEXTILE DYEING & PRINTING CO. OF AMERICA, INC.

**REQUEST TO ENGINEERING DEPT.** № 4951

GIVE COMPLETE SPECIFICATIONS FOR WORK WANTED.
IF ESTIMATE IS WANTED FOR APPROVAL BEFORE PROCEEDING WITH WORK MARK X AND SIGN HERE ☐
DO NOT SIGN BELOW UNLESS NO ESTIMATE IS WANTED OR ONLY IF ESTIMATE IS SATISFACTORY TO YOU.

| FOR DEPT. (NO.) | NEW (N) OR REPAIR (R) | DATE WANTED | (FOR ENG. DEPT.) ORDER NO. | ISSUED TO DIVISIONS |
|---|---|---|---|---|
| | | | | |

(FOR ENG. DEPT.)

DATE ISSUED _____ DATE RECEIVED _____
REQUESTED BY _____ DATE APPROVED _____
APPROVED BY _____ EXECUTIVE APPROVED BY _____ PLANT ENGINEER

Form 003 (7-33)

**FIGURE 2**

## DAILY TIME CARD
ENG. DEPT.

No. _____ DATE _____
NAME _____ RATE _____
DIVISION _____ SIGNED _____ FOREMAN

| CLOCK READING | TIME | COST | | DESCRIPTION | ORDER No. | √ |
|---|---|---|---|---|---|---|
| | | | F | | | |
| | | | S | | | |
| | | | F | | | |
| | | | F | | | |
| | | | S | | | |

TOTAL ELAPSED TIME
PAY CARD TIME

Form 751 (3-33)

**FIGURE 4**

Sizes of original forms:
Figure 2. 8x5½ inches
Figure 3a. 9½x6 inches
Figure 3b. 9½x6 inches
Figure 4. 5x9 inches

TEXTILE DYEING & PRINTING CO. OF AMERICA, INC.

**SHOP SUB-ORDER** No.

TO FOREMAN: _____ DIVISION, ENG. DEPT.

PLEASE EXECUTE THE WORK AS SPECIFIED BELOW. ALL LABOR MUST BE CHARGED WITH THIS ORDER NUMBER ON "DAILY TIME CARD". "MATERIAL USED DAILY REPORT" IS NOT REQUIRED WITH THIS ORDER. NOTE ANY SPECIAL INFORMATION IN CONNECTION WITH THIS ORDER ON REVERSE SIDE IF CONSTRUCTED OTHER THAN AS SPECIFIED. ON COMPLETION OF ORDER RETURN PROMPTLY TO ENG. OFFICE.

Date Issued .....
Request No. .....
Made out by .....
Checked by .....

TEXTILE DYEING & PRINTING CO. OF AMERICA, INC.

**SHOP ORDER** No. K _____

TO FOREMAN: _____ DIVISION, ENG. DEPT.

PLEASE EXECUTE THE WORK AS SPECIFIED BELOW. ALL LABOR MUST BE CHARGED WITH THIS ORDER NUMBER ON "DAILY TIME CARD." ALL MATERIAL MUST BE CHARGED AS INSTRUCTED ON "MATERIAL USED DAILY REPORT." NOTE ANY SPECIAL INFORMATION IN CONNECTION WITH THIS ORDER ON REVERSE SIDE IF CONSTRUCTED OTHER THAN AS SPECIFIED. ON COMPLETION OF ORDER RETURN PROMPTLY TO ENG. OFFICE.

Date Issued .....
Request No. .....
Made out by .....
Checked by .....

CONCURRENT ORDER TO
A—MACHINE SHOP .....
B—PIPE FITTERS .....
C—ELECTRICIANS .....
D—CONSTRUCTION .....
E—CARPENTERS .....
F—PAINTERS .....

TITLE _____

REQUESTED BY _____ DEPT. _____ DATE WANTED _____

ESTIMATED COST
LABOR .....
MATERIAL .....
TOTAL

DATE COMPLETED _____ ACCEPTED _____ REQUESTOR
SIGNED _____ FOREMAN ENG. DIVISION APPROVED _____ PLANT ENGR.

COST SUMMARY
LABOR .....
MATERIAL .....
TOTAL

Form 672R - 11-33

**FIGURE 3a**

WANTED

REQUESTOR
PLANT ENGR

LABOR SUMMARY
COST

**FIGURE 3b**

Figure 5. 9½x6 inches
Figure 6. 5½x2⅝ inches

The daily time card (Figure 4) provides space for recording eight jobs

TEXTILE DYEING & PRINTING CO. OF AMERICA, INC.

**MATERIAL USED DAILY REPORT** ENG. DEPT.

SHOP ORDER No. K _____ DATE _____ APPROVED BY _____

INSTRUCTIONS: THIS REPORT MUST BE MADE OUT DAILY BY FOREMAN OR WORKMAN, AND APPROVED BY FOREMAN, FOR ALL MATERIAL USED FROM STOCK FOR EACH "K" TYPE SHOP ORDER, AND IS TO BE TURNED IN DAILY TO ENG. OFFICE REGARDLESS WHETHER OR NOT JOB IS COMPLETED. DO NOT LIST ANY MATERIAL WHICH CARRIES A GREEN TAG WITH SHOP ORDER NUMBER AS IT HAS ALREADY BEEN CHARGED TO JOB. A SEPARATE REPORT IS REQUIRED FOR EVERY "K" SHOP ORDER NUMBER.

| QUANTITY | MATERIAL | (For Purchasing Dept.) PER | UNIT PRICE | TOTAL | REMARKS |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Form 749 (5-33) MADE OUT BY _____ TOTAL

**FIGURE 5**

RESERVED FOR

**JOB No.** _____

Purchase Order No. _____

Requisition No. _____

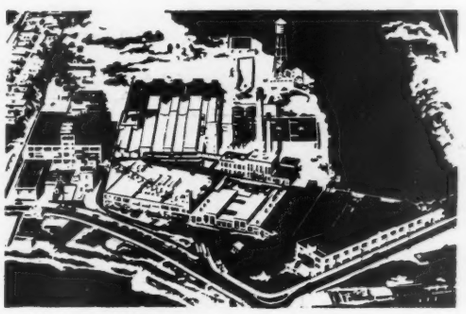
Form 757 (4-33)

**FIGURE 6**

order number reveals in code form the information which is invaluable to the fulfillment of the cost and control functions.

Editing of the order now resolves itself first into the careful determination of a number, then a selection of the title, and finally a brief translation of specifications, which may of course be accompanied by sketches or blueprints. When the job involves participation by more than one division of the engineering department, a separate order is issued to such divisions under the same title and order number, except that the suffix letter of the number is made to correspond to the division, and the space entitled "concurrent orders" is so marked.

Shop routine of both types of orders is the same. The original copy is sent to the respective division noted by the suffix key-letter. The duplicate copy is placed in the first partition of a special box file in the engineering office, called the *Control Box,* which has three partitions, labeled *New, Active,* and *Completed,* respectively. It remains in the "new" partition until receipt of notice that work has begun, as will be described later. The original order is placed in a somewhat smaller but similar control box had by each divisional foreman at the base shop.



We have now developed the system to a point where a request for work has been definitely recorded, and the request has been translated to a divisional foreman by an order which is always under the control of the engineering office. The control box in the engineering office is to the plant engineer a dependable index of his operating requirements, and the control boxes in the hands of the divisional foremen are merely sub-divided delegations of this work.

### Enter Control

At this juncture the function of control becomes aptly prominent. The marking of "date wanted" on the order usually serves to indicate to the foreman when to make the order active. Theoretically this plan is ideal, but practically the establishment of a schedule of active work is one so subject to variable influences that only sensitive human judgment can intelligently direct and control it. It is true that control cannot be exercised without a system, but it must be equally and more forcefully evident that even the most perfect system cannot fulfill control functions without the pressure of executive influence. The essential features of control are therefore beyond description other than to add that it is exercised by daily or periodic conference between the operating executives and the plant engineer, and these decisions are subsequently relayed down the line of divisional foremen through the indispensable medium of accurate reference to the order system.

There will be noted along the top edge of the order forms a series of numerals from 1 to 31. These numerals are designed for registering the dates of work activities, but are principally intended for notation with colored steel signal tabs to simplify control and follow-up, if necessary, of all important manufacturing orders.

### Daily Time Card

The use of the *Daily Time Card,* Figure 4, involves more than the final assembly of detailed labor costs. The card has also been designed to create to some extent the same relationship of control between the foreman and the workman that is afforded between the engineering office and the foreman by the shop order forms.

Each division has been equipped at the base shops with time-card racks into which the daily time cards are placed at the close of the day by the engineering office. These cards have already been stamped with the name, badge number, division symbol, and date for each workman, but the rate is omitted. At the start of work, the workman receives one or a series of assignments from his foreman, which are *written* on the daily time card in order of preferable attention, *by identification of an order number,* together with a descriptive title, and are supplemented by appropriate verbal explanation. A standard type job recorder clock is used for time recording. The interruption of a job during the day for an emergency assignment is easily handled by first punching "finish" time to the current job, then by properly recording the emergency job in a blank space on the card, and finally by making another entry for the current job in another blank space when it is resumed. Job recorder clocks are located at strategic corners of the plant to minimize non-productiveness.

At the close of the day every card is punched and turned in to the foreman for inspection and approval whether or not all the assigned jobs have been completed. Any open jobs are carried over and entered on the next day's card.

Let us return for a moment to the shop order which has been placed in the "new" partition of the foreman's control box. When the foreman assigns a new order to a workman, he removes the order from the new partition, checks the numeral at the top of the form to indicate the date of action, and places the order in the "active" partition. He also places a check mark in the space provided on the extreme right of the daily time card, which indicates that work on that particular order has been initiated. This simple expedient, as will be shown later, eliminates the necessity for a weekly or even daily foreman's progress report, and also minimizes the effort required of the engineering office in ascertaining the status of an order.

Upon the completion of an order, obviously the foreman transfers it from the active partition, after dating and signing, to the "completed" partition, from which it is collected by the engineering office at the close of the day together with the daily time cards.

### Material Used Daily Report

The distinction between the two types of shop orders will be recalled as only the questionability of getting

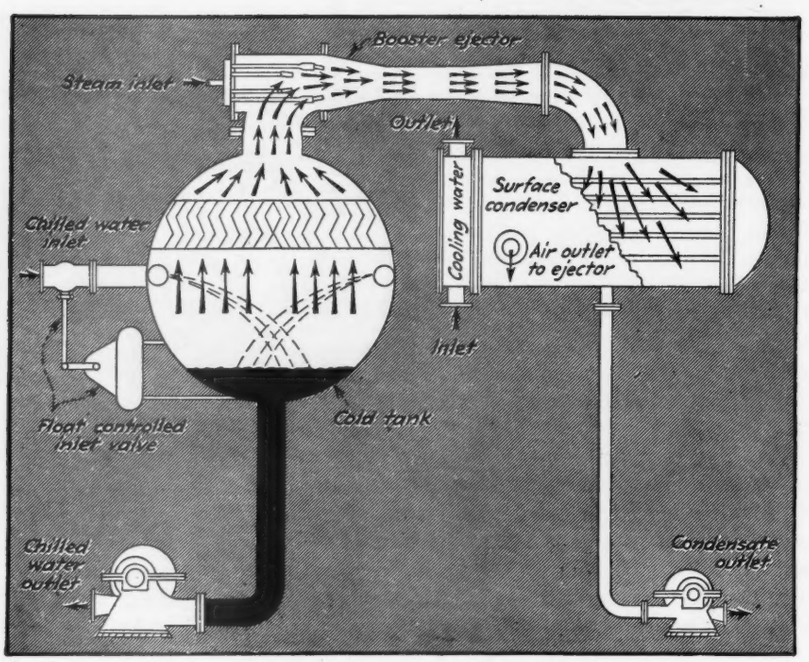
*(Continued on advertising page 44)*

# COLD—*from* STEAM!

***Old in principle, but new in its commercial application, steam jet refrigeration may be the right answer to air conditioning and process cooling needs***

▼

**Figure 1. Arrangement of principal elements of a steam jet refrigerating unit**




EVERYONE knows that at sea level water boils at 212 deg. F., whereas on top of a mountain it boils at a lower temperature. The reason is that the pressure above the water has been reduced, making evaporation easier. If water is inclosed in an airtight vessel and the pressure further reduced, the water will boil at still lower temperatures, eventually reaching 35 or 40 deg. Fahrenheit.

When water boils vapor is generated, which, if it were allowed to remain in the vessel, would increase the pressure and therefore the boiling temperature. Therefore, in order to keep water boiling at a low temperature the vapor must be removed as fast as formed.

Each pound of water vapor generated requires the addition of about 1,000 B.t.u. of heat and if this heat does not come from outside the closed vessel it must come from the water inside the vessel. Therefore, the generation of 1 lb. of vapor removes enough heat from the remaining water to cool 200 lb. of water 5 deg. F. or, say, from 50 deg. to 45 deg. Fahrenheit.

If water is sprayed into an airtight vessel and the vapor removed fast enough to maintain an absolute pressure of 0.3 inch of mercury, the water temperature in the vessel will be about 45 deg. F., which is the boiling point of water at that pressure. If the vapor removed from the vessel is compressed to a higher absolute pressure with a steam jet compressor, or booster ejector, the fundamental elements of a steam jet refrigeration system are present. The apparatus required to complete the unit is the steam condenser, of the direct contact or surface type, required to condense the steam used in the booster ejector as well as the vapor it compresses. Also needed are the condenser air removal unit and the pumps to handle the chilled water, the condenser cooling water, and the condensed steam and vapor, if the condenser is of the surface type.

Such a system is shown diagrammatically in Figure 1. The water to be cooled enters the spray tank through the float-controlled inlet valve at the left of the unit, passes through the two spray pipes and is ejected into the tank in a series of thin sheets. Since the water is somewhat warmer than the equivalent temperature corresponding to the absolute pressure maintained in the tank, it tends to vaporize immediately. A portion does vaporize and, as explained previously, this action cools the remainder to the equivalent pressure-temperature. The cooled water falls to the bottom and is withdrawn and delivered to the load by the chilled water pump.

The spray tank (or cold tank, as it is sometimes called) is made large in horizontal cross section in order

*E. F. Stalcup*

*Westinghouse Electric & Manufacturing Company*
*Philadelphia, Pa.*

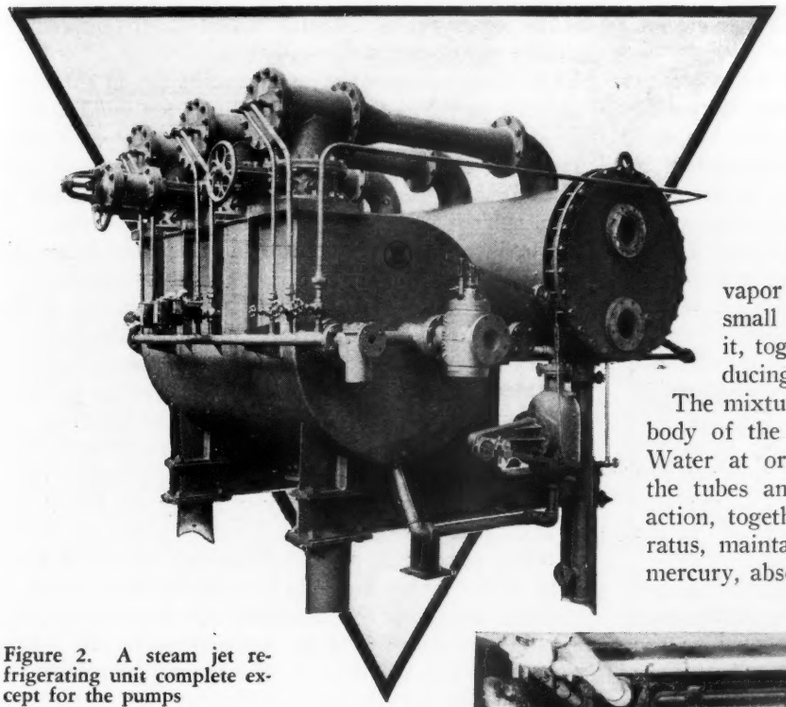


Figure 2. A steam jet refrigerating unit complete except for the pumps

Figure 3. This 156-ton refrigerating unit makes summer more comfortable for the occupants of a large office building

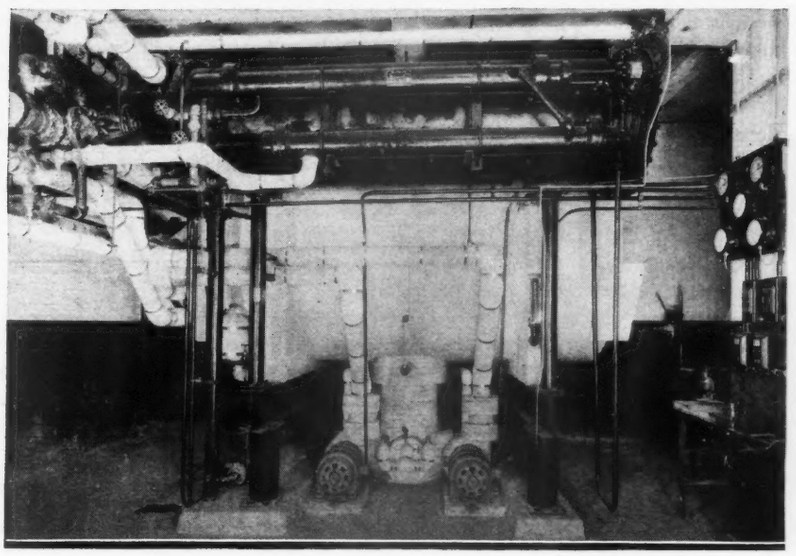
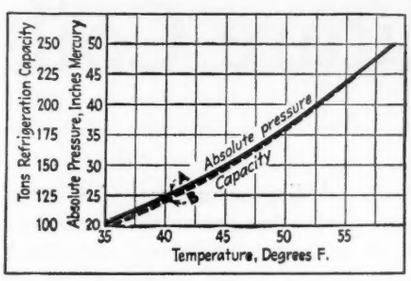


Figure 4. Curve *A* shows the relation between the temperature of water vapor and the absolute pressure. *B*, how the capacity of a steam jet refrigerating unit varies with the temperature of the chilled water leaving the unit




to keep the area of the sprayed water as great as possible and thus reduce the velocity of the vapor. The vapor is drawn upward through a moisture eliminator, to prevent it from carrying free drops of water over into the remainder of the system. Any free moisture carried over by the vapor represents a loss in capacity, since make-up water must be cooled to take its place; hence, the care taken to guard against this loss.

The next item in the list of apparatus comprising the steam jet unit is the steam jet compressor, or booster ejector, which is the heart of the system. In the booster ejector steam is expanded through a group or groups of nozzles in which it attains a velocity of about 4,000 ft. per sec. These high velocity streams drag along the vapor from the spray tank and compress it into the small throat of the booster diffuser from which it, together with the steam, is expanded with reducing velocity out to the end of the booster.

The mixture of steam and vapor passes into the open body of the surface condenser surrounding the tubes. Water at ordinary temperatures is circulated through the tubes and condenses the steam and vapor. This action, together with the use of the air removal apparatus, maintains a back pressure of about 2 inches of mercury, absolute, on the booster ejector, which enables it to function without an excessive quantity of steam.

The condensate pump, air removal unit, and condenser cooling water pump will not be discussed, since their construction and the reasons for their use are well understood.

A complete refrigerating unit, without the pumps, is shown in Figure 2. This is a 75-ton capacity unit installed in the plant of a large rayon manufacturer to produce the cold water used in air conditioning the work rooms. The main steam header is at the front. It is protected by a steam strainer and feeds the branch steam lines to the three booster ejectors, as well as the two-stage air ejector on the far side of the condenser. The water to be cooled enters through the float-controlled inlet valve on the near end of the cold tank and flows into the tank from the two spray pipes located within the tank along the sides, as shown in Figure 1. The three booster ejectors extract the vapor from the top of the cold tank and introduce it into the top of the surface condenser.

The capacity of the unit can be adjusted by varying

the number of booster ejectors in use. A booster ejector is inherently a full-capacity unit. Its capacity could be altered by throttling the suction valve, but its efficiency would decrease since the full steam consumption would be required, regardless of load. The preferable and common practice where a variable load is anticipated is to divide the total capacity of the unit among three or more boosters so that an approximation of the capacity required can be made. Then, as shown in Figure 2, one of the boosters is provided with automatic control responsive to a thermostat located in the chilled water. With this arrangement the automatic booster is turned on and off to take care of varying loads within its capacity range. The other boosters are manually controlled through the suction and steam valves.

Fundamentally steam jet vacuum-cooling units are especially applicable to that general class of refrigeration work where the temperatures to be maintained are above the freezing point of water, or 32 deg. F. Study of the curves in Figure 4 will show why this is true.

These curves show that a steam jet refrigerating unit increases in capacity rapidly as the chilled water temperature increases, and is closely proportional to the absolute pressure maintained in the cold tank. Since the steam consumption of the unit does not change greatly over the entire range and the amount of condenser water is increased only moderately, due to the additional heat from the refrigeration vapor, it follows that the higher the permissible chilled water temperature the more economical the installation.

This characteristic of steam jet units fits in especially well with so-called "comfort cooling" air conditioning, since it provides extra capacity on the hottest days when low cooling temperatures are not needed. It is likewise applicable to air conditioning in the confectionery, rayon, cotton, rubber, petroleum, and chemical industries.

An application in the comfort-cooling field is seen in Figure 3, which shows a 156-ton unit in combination with an internal heat exchanger, installed in one of the largest office buildings in New York City for cooling a portion of the office and store space. In this installation cold water is circulated through fin-type cooling elements located under the windows throughout the building.

In general steam jet units require more water for the condenser than do compression-type refrigeration units, although this feature is usually offset by the lower first cost and operating cost.

Moving parts are restricted to two or three small pumps which makes for ease in adapting this system to restricted spaces, or in locations where freedom from noise and vibration may be a deciding factor. Also, little attention is needed. A 35-ton unit which was installed in 1918 for cooling the drinking water in a plant has been in continuous service since that date and has required no maintenance except minor packing renewals and a small patching job on the body of one pump.

▼ ▼ ▼

# How to Arrange Leads in Wire-Wound Armature Coils

*A. C. Roe*

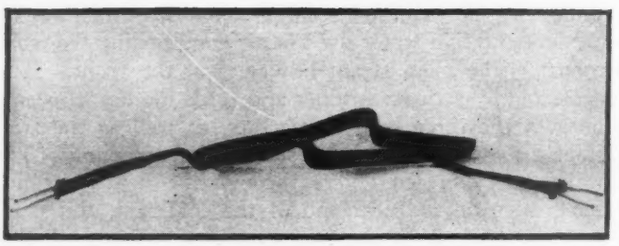
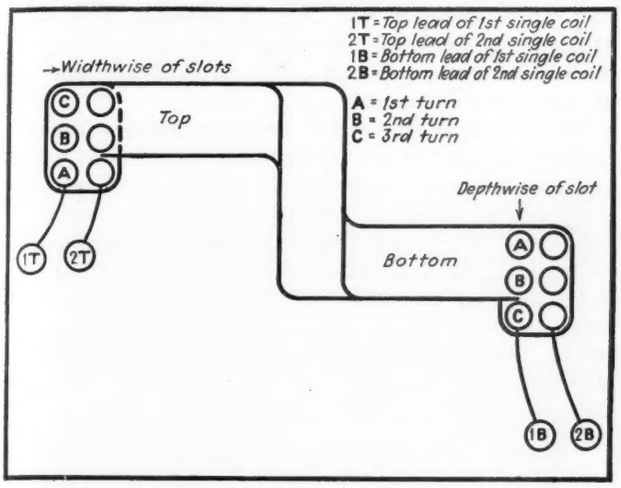


**Figure 1. Diamond-type coil with the turns built up depthwise and single coils placed widthwise in the slots. The leads are on the bottom**

▼

PROCEDURE in winding armatures of the type using armature coils that are fabricated from round, square, or rectangular insulated wire, can be divided into a number of operations. Two of the most important operations are the connecting of the bottom leads and top leads to the commutator. In these two operations the winder must handle a large number of leads and bring them from the coil across the front end of the armature and into the proper commutator neck. In laying the bottom layer of leads the winder must make certain bends and twists in them. Also, in laying the top leads they must be twisted and bent in a certain manner in order to insure the proper sequence. There are, then, a number of details in conjunction with the connecting of coil leads to the commutator that are of much importance.

These details vary with the type, shape, and construction of the coil used in winding the armature. In this and succeeding articles the major types of wire-wound




**Figur 2. Lead arrangement of diamond-type coil which is shown in Figure 1**

armature coils will be discussed, with the proper methods of twisting, insulating, and laying down the bottom and top layers of leads. In this discussion the distribution of the turns and wires in the slots will be described for each type of coil, so that the reason for certain twists and bends in the leads will be better understood, thus making it easier to test for sequence and locate trouble.

Wire-wound coils used in the armatures of various types of industrial and railway motors vary in shape and construction, which results in a variety of lead arrangements. The ratio of the number of armature slots to commutator bars, number of wires per bar, shape of coil, and method of winding the coil all combine in each case to affect the way in which the leads are brought out from each coil side, and hence the method necessary to connect the leads to the commutator neck.

**It costs good money to rewind motors, more good money to do the job over if it is not done right the first time, and still more good money if production equipment stands idle all the while**

To insure thorough understanding of the description that will be given of the various types of wire-wound coils and the method of bringing out the leads, these definitions should be kept in mind:

*Wire-wound* is a term that applies to coils fabricated from round, square, or ribbon wire, covered with standard insulation, like double-cotton covering or asbestos.

*Wires per bar* refers to the total number of active coil leads contained in each bar, and does not include any fillers. For example, "two wires per bar" means that each bar has connected to it one top and one bottom coil lead; "four wires per bar" indicates that each single coil is wound with two wires in parallel, since half the wires per bar are from one coil side, and each bar must have leads from the top and bottom coil halves. Thus, the number of wires per bar is a check on the number of wires in parallel for each single coil.

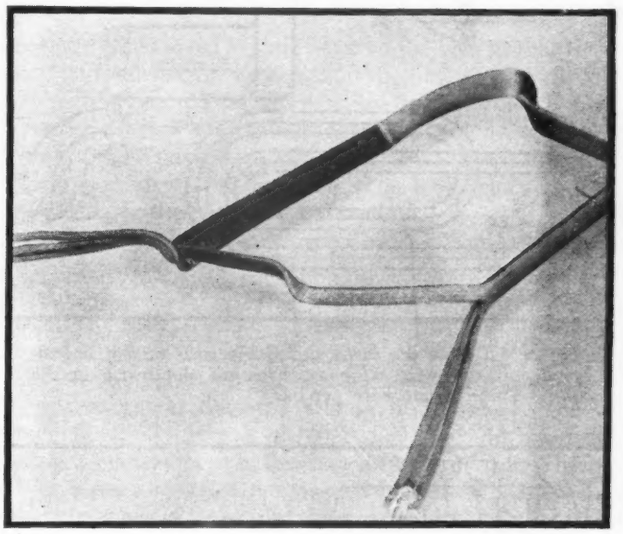


**Figure 3. A diamond-type coil with the turns and single coils arranged depthwise**

*Wires per sleeve.* The latest practice is to put all the lead wires per single coil that are in parallel in one common covering (for example, two wires per sleeve when two wires per single coil are in parallel) in order to reduce the chances of error in pairing off the wires when connecting them to the commutator.

*Single coil* can be defined as the unit connected between two commutator bars; there are as many single coils as there are commutator bars. Any armature coil or winding unit is made up of a number of single coils, and there will be as many single coils per coil as the ratio of slots to bars. For example, 25 slots and 125 bars means 5 single coils per coil or winding unit.

For all practical purposes wire-wound coils can be divided into the following three groups or types, according to their general shape: (1) diamond type; (2) drop type; (3) short type. The diamond types of coils will be considered first, since they cover a greater range of combinations.

### Diamond-Shaped Coils

Figure 1 shows one type of diamond-shaped coil wherein the turns per single coil are built up depthwise and the single coils are arranged widthwise or crosswise in the slots. On these coils the leads are brought off from the bottom of the coil at the end of each slot section. With coils of this type the sequence of the leads for each single coil is widthwise, or left to right across the slot. There may be from one to six single coils per coil; if there are two or more wires in parallel per single coil, these wires should be picked up depthwise as top to bottom. Figure 2 will help to explain the arrangement.

In Figure 2, *1T* and *1B* indicate the leads and their

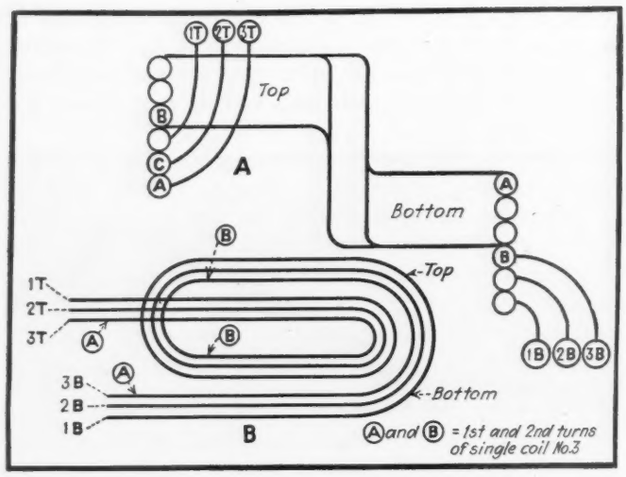



**Figure 4. How the turns and single coils of a diamond-type coil one wire wide are arranged depthwise in the slot. There is one wire per bar**

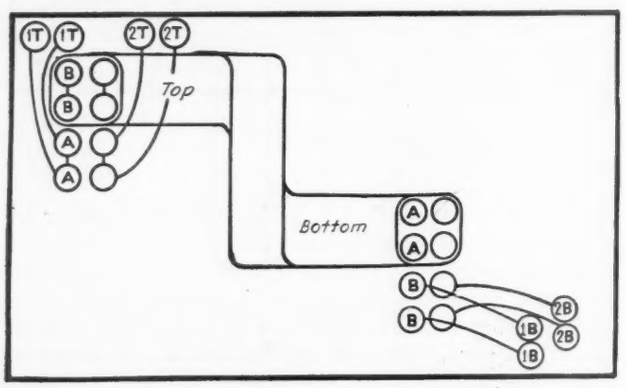



**Figure 5. Diamond-type coil with two single coils each consisting of two turns of two wires in parallel. There are four wires per bar**

position for one single coil. Similarly *2T* and *2B* show the location and sequence of the leads for the single coil, since there are two single coils per coil. Letters *A, B,* and *C* indicate how the turns of each single coil are built up depthwise in the slot. In all of the diagrams in this and the succeeding articles figures will be used to show the lead sequence, and letters will be used to indicate turn build-up.

When winding an armature with coils of the type shown in Figures 1 and 2, the bottom leads are kept in the position that they leave the coil. The top leads must be bent up against the coil, as shown at the left in Figure 1, this bend being kept around on the slot section of the coil, to prevent building up at this point. The top and bottom leads are each put down in one layer.

### Coils One Wire Wide

Figure 3 shows a diamond-type coil that is only one wire wide and in which the leads are brought off from the bottom and at the end of each slot section. The single coils and turns are both built up depthwise; the coil shown has three single coils, each consisting of two turns. How the single coils are located in the slot sections is shown in Figure 4. Note that single coil No. 1 has its top lead *1T* located near the middle section of the coil, whereas bottom lead *1B* of this coil is brought off from the lowest part of the bottom half of the coil. This is due to the turnover of the wires around the pins at each diamond point.

When connecting the coil, shown in Figures 3 and 4, to the commutator, the bottom leads are twisted to the right, as shown by leads *1B, 2B* and *3B* in Figure 4*A*. Then the top leads are bent up against the coil and the leads twisted to the right, as indicated by the position of leads *1T, 2T,* and *3T*. The loop in Figure 4 *B* shows how the arrangement of the leads in Figures 3 and 4 is brought about by the turns being bent 180 degrees around a pin at each end of the coil. Thus, the wire that was on the bottom of the top half of the coil is on the top of the bottom half of the coil.

### Twist of Single Coil Leads

With the type of coil shown in Figures 3 and 4 the correct twist must be given to each group of single coil leads; that is, the bottom leads must be twisted so that the top lead of this group is brought over to the right, and the top leads are twisted so that the bottom lead of this group is brought around to the right. This shaping is necessary in order for each layer of leads to have the proper sequence to permit being laid down in one layer.

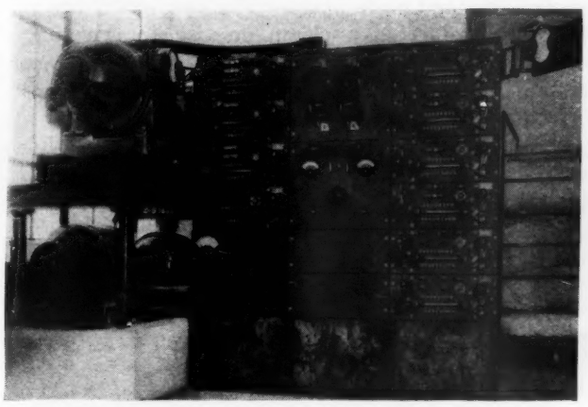
With coils of the type shown in Figures 1 and 2 having leads on the bottom, the top lead is also the starting lead or the starting point when winding the coil. When the leads are on top the bottom lead is the starting lead. These rules apply regardless of whether the coils are wound to shape on a mold, or wound in shuttle form and then pulled to shape.

### Leads on the Bottom

Figure 5 shows a diamond coil similar to Figure 1 except that it has a different arrangement of leads and single coils. There are two single coils each consisting of two turns of two wires in parallel, the turns and wires in parallel being built up depthwise and the single coils widthwise. The fact that the leads are on the bottom necessitates bending the top leads up. In order to keep the bulk to the thickness of one wire, the leads are bent as shown—that is, the two upper leads of the group are bent straight up, whereas the lower *1T* lead is bent to the left and then up alongside of the other *1T* lead. Likewise the lower *2T* lead is bent to the right and then up. Hence the leads are fanned out four wide. All leads are put down in two layers so that the bottom leads can be led directly to the commutator, in the arrangement which Figure 5 shows.

**This is the first of three articles on how to arrange leads in wire-wound armature coils. The second article is scheduled for May and will cover diamond-shaped pulled, double-loop, and drop-type coils**

# MAINTENANCE SHORTS



*Photograph by courtesy of MacNutt, Watts & Tankard, New York*

## Double-Decked Chargers Save Space

Two battery-charging units for the fleet of electric trucks of the National Family Laundry, New York, were mounted one on top of the other because space was at a premium. The base of the bottom set is so arranged that the unit may be easily removed for maintenance work.

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## How to Lay a Gravel Roof That Won't Leak

Wm. C. Betz, Master Mechanic, Fafnir Bearing Company
New Britain, Conn.

When a gravel roof starts to leak it is best to rebuild it from the bottom up. Patching is not economical because a repaired roof will not last long enough to pay for the labor put on it.

After removing all gravel and tar paper, boarding for the foundation should be examined. Boarding should be laid edge to edge or, better still, tongued boarding should be used. If the boarding is in good condition lay the tar paper as follows:

Start at the high side of the roof and swab a strip of hot tar about 1 ft. wide for the entire length. Next, lay a strip of tar paper over the tar and tack down with roofing disks and galvanized nails along the upper edge only. Swab the bottom of this strip of paper for a width of 1 ft. with hot tar and run a second strip of paper overlapping the first strip by this amount, tacking the same as the first strip.

Repeat this process until the edge of the roof is reached with the paper; then tack the paper again.

Swab a heavy coating of tar over the entire surface of the roof, beginning at the top, and cover with a second layer of paper which is not tacked but is stuck to the bottom layer by the tar. This second layer should be put on to overlap only 6 in.; position the laps so that they come halfway between the laps in the first coating.

The roof should be finished by giving it an extra-heavy coating of hot tar which is covered immediately with fine sand gravel. After the tar has cooled, the roof should be swept with a rattan broom to remove loose gravel and is then ready for service.

Flashings made from tar paper and generously swabbed with tar should be built up around water drains, vent pipes, and chimneys over the first coating of paper so that their flanges are held fast between the first and second layers of paper and tar.

The first layer of tar paper is not pasted directly to the boards, except at the top, because if this were done it would be almost impossible to remove the old paper to put on a new roof. Furthermore, the paper would come off in spots and leave humps and hollows which would not only make a new roof look unsightly, but shorten its life.

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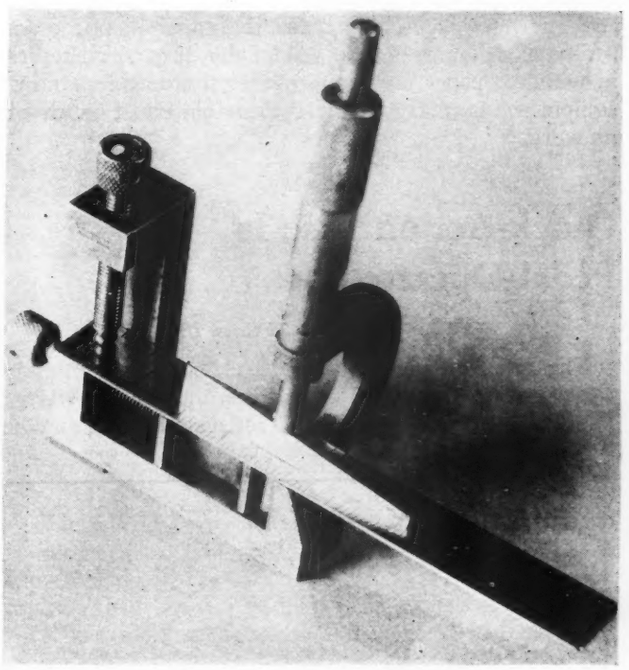

## This Way It's Much Easier to Measure Tapers

W. H. Moore, Hamliton, Ont.

A method for measuring tapers that I have used for years, and original so far as I am aware, is shown. I use an ordinary vise clamp to hold the micrometer upright and another to clamp a scale on top of the first. To test the taper per inch of a key or wedge, for example, it is necessary only to place the end of the work

on an even inch mark on the scale, take a reading with the micrometer, then move the work up one inch and take the next reading. The difference represents the amount of taper in one inch.

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## Removing Static from Exhaust Ducts

FRANK ELLWOOD, Fairbury, Ill.

A printing concern specializing in large-volume catalog work installed an exhaust system to pick up paper shavings from the trimmers and carry them away to be baled. The installation is very similar to that used in handling shavings in a woodworking plant. However, the passage of the dry paper shavings at high velocity through the metal ducts developed a high charge of static electricity which was especially heavy at the elbow on the inlet to the suction fan. As men were constantly working or passing close to this elbow, the severity and unexpectedness of the shock made it a potentially serious hazard.

The static has been eliminated by installing in the elbow a number of spray nozzles connected to a 90-lb. water line. The amount of water discharged is controlled by the man in charge of baling the paper. Not enough water is used to make the paper damp; practically all moisture is absorbed by the dust which settles in with the paper and thus relieves the dust separating equipment, auxiliary to the cyclone outlet, of much of its work.

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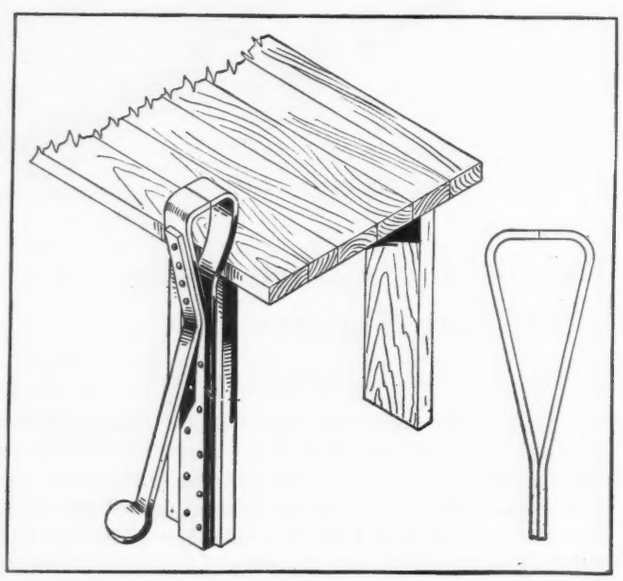
## Quick-Action Vise Is Pedal-Operated

JOHN E. HYLER, Peoria, Ill.

The vise is made of spring steel, holds itself tightly closed, and is opened by treading on the pedal. A large flat bench leg must be provided for mounting; it may be flush with the front edge of the bench, or faced with a second piece extending beyond the bench front, depending upon the shape of the vise jaws.



Two pieces of spring steel of weight depending upon the size of vise are bent and fastened together in a pair. The bending allows the surfaces that are to be fastened together to stand wide apart. The two pieces are then squeezed together in a clamp or vise for riveting or welding, this acting bringing the jaws into tight compression. Use care to see that the two jaws register perfectly.

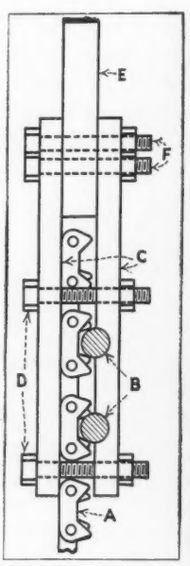
This assembly is fastened to the bench leg as shown, with heavy screws in stagger formation. The pedal is then forged to shape, and is attached to the front vise jaw by riveting or welding.

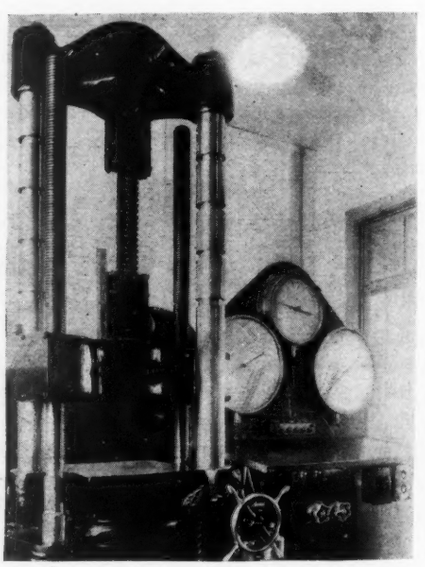
•

## Temporary Testing Jigs

W. E. STEWART, Sewaren, N. J.

In every manufacturing plant occasions arise when it becomes necessary to make a single test which may not be repeated for years. Preferably, testing jigs for such jobs should be inexpensive and easily made. The accompanying illustrations show how one such problem was solved.



A 3-in. silent chain drive, which was used between a motor and a heavy gear train, repeatedly broke, although it was installed in accordance with the chain manufacturer's recommendation. A test to determine the ultimate strength of the chain was indicated, and clamps for holding it in the testing machine were necessary. The clamps were to be made so as to apply the load uniformly to all segments of the chain. The obvious method of milling teeth in a rectangular steel bar was discarded because of the expense and time required. Instead, the jig was made entirely of stock material and required only a saw and drill press for the machine work.

The chain *A* meshed with two round steel rods *B* which were seated in slots in one of the clamps *C*. The

chain was held firmly in place between the clamps by tightening the bolts $D$, and the tongue $E$ was gripped by the jaws of the testing machine. The slots for the round rods were made by clamping the two pieces of steel together and drilling down through their intersection.

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## Too Many Turns Cause Trouble in Coil

GRADY H. EMERSON, Birmingham, Ala.,

When rewinding a burned-out magnet or other kind of coil satisfactory results can usually be obtained by weighing the old coil and then making the new coil the same weight as the old one. Of course, the same size and kind of wire must be used. A seemingly trivial neglect of this precaution recently caused trouble.

A coil for a freight elevator control had been rewound, but since the proper size of cotton-covered enameled wire was not available the winder substituted plain enameled wire in place of it. This expedient would not have been objectionable had he not used the same amount of wire by weight, which gave a considerably larger number of turns. As a result the coil was operating under too low voltage, so that after one or two operations the contacts would stick. This trouble was remedied temporarily by unwinding enough turns to make the switch operate properly. Later, it was necessary to wind and install a new coil having the correct number of turns.

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## Determining Power Factor with Ammeter and Resistor

M. M. ROSE, Electrical Engineer
Electric Generator & Motor Company, Cleveland, Ohio

For quickly checking the power factor of a load a simple method that requires only an ammeter and a suitable resistor or condenser will be found convenient and sufficiently accurate for ordinary work.

Figure 1 shows a three-phase load protected by a three-pole, fused line switch. Suppose it is desired to

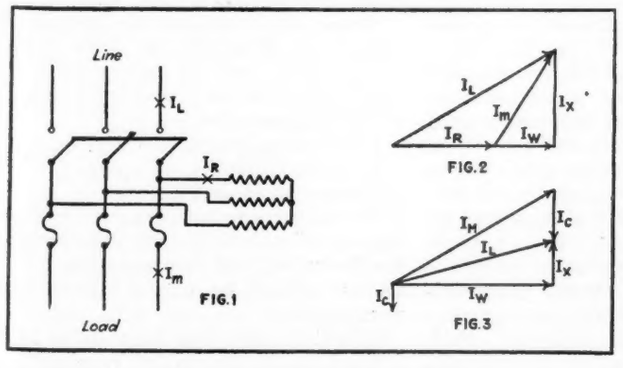


FIG. 1



FIG. 2



FIG. 3

determine the power factor of the load. Ahead of the fuses, in order not to overload them, add a resistance load of practically unity power factor. This load may consist of any convenient resistor connected either star or delta. I have used grid banks or lamps, depending on which was available and the value of the main load current. The purpose of the auxiliary resistance load is, of course, to provide a base line of known power factor. For a resistance load the power factor may be taken as unity.

If current readings are taken at $I_L$, $I_R$, and $I_M$ a diagram may be constructed, as shown in Figure 2, in which $I_W$ is to be determined.

The equation of the two right triangles may be expressed:

$$I_L^2 = (I_R + I_W)^2 + I_X^2 = I_R^2 + 2\,I_R\,I_W + I_W^2 + I_X^2 \ldots \quad (1)$$

$$I_M^2 = I_W^2 + I_X^2 \ldots \quad (2)$$

Subtracting equation (2) from (1):

$$I_L^2 - I_M^2 = I_R^2 + 2\,I_R\,I_W, \text{ and}$$

$$I_W = \frac{I_L^2 - I_M^2 - I_R^2}{2I_R}$$

For example, suppose these readings were secured with an auxiliary resistance load:

$I_L$, 9 amp.; $I_R$, 5 amp.; $I_M$, 5 amp.

Then,
$$I_W = \frac{81 - 25 - 25}{2 \times 5} = 3.1, \text{ and}$$

$$\text{Power factor} = \frac{3\ 1}{5} = 62 \text{ per cent}$$

If instead of a resistance load a condenser is available, the diagram will be as shown in Figure 3. For the triangle involved:

$$I_X = \frac{I_M^2 - I_C^2 - I_L^2}{2I_C} \text{ Hence,}$$

$$I_W^2 = I_M^2 - (I_C + I_X)^2$$

Assuming these readings with a condenser load:

$I_M$, 5 amp.; $I_L$, 3.26 amp.; $I_C$, 2.92 amp.,

$$I_X = \frac{25 - 10.62 - 8.51}{2 \times 2.92} = 1$$

$$I_W^2 = 25 - (2.92 + 1)^2 = 9.64$$

$$I_W = 3.1$$

$$\text{Power factor} = \frac{3.1}{5} = 62 \text{ per cent.}$$

Where loads are fluctuating it is necessary to take simultaneous readings of $I_L$ and $I_M$, the value of $I_R$ being practically constant unless there is a wide variation in the voltage under different load conditions.

If the load is steady a recently developed instrument comprising an ammeter and a current transformer can be used and will eliminate the necessity of breaking line circuits.

It is not essential that the current taken by the auxiliary resistance load be of any fixed value. Around any shop there are usually spare resistors with a certain ampere rating, and any combination may be used to obtain the desired load. In the example given, where the motor current is 5 amp., the resistor current might have been $4\frac{1}{2}$ to $5\frac{1}{2}$ amp., more or less.

When determining the power factor of small loads on a 110-volt circuit a lamp bank may be used. In the case cited, five 100-watt lamps would serve if the load were single-phase.

# QUESTIONS and ANSWERS

*Conducted by G. A. VAN BRUNT*

## Replacing Elevator and Crane Cables

*I should like to know how to determine positively when the wire cables used on elevators and cranes should be replaced. We want to use these as long as it is safe to do so, but do not want to take any chances of failure by keeping them in service too long. How often should such cables be inspected? What is their normal length of life?*
*C.A.—Minneapolis, Minn.*

JUST WHEN a cable should be replaced is difficult to say. Where the conditions are severe, involving heavy loads, reverse bends, continuous service, it may be necessary to discard a cable sooner than would be the case if conditions were more favorable.

A safe rule to follow is to condemn a cable when six wires are broken in one strand lay. Use of this rule and sound judgment, combined with experience, will get about all the service a cable can give.

The length of life depends upon many factors and may extend over a period of a few months or many years. It is my opinion that car mileage gives a better record of cable service than the number of weeks or months that it has been in use. Frequency of inspection will depend upon the service conditions. Where service is continuous and heavy loads are handled, inspect weekly.

The method of roping up the machine influences the life of the cables. On the full-wrap-type traction machine the cables make two wraps over the traction sheaves and one half-wrap around the secondary sheave, or three 180-deg. bends in one direction. With the V-grooved-type traction machine the cable makes only one 180-deg. bend but it is subjected to wedging action in the grooves.

The cables travel twice as fast as the car on the 2-to-1 roped traction machine; therefore the car mileage will be less than with 1-to-1 roped machines, where the car and ropes have the same speed. The condition of the sheaves has a decided effect upon the life of the cable; hence they must be kept in good condition.

Cables must be installed properly, or their life will be shortened. Carelessness in starting and stopping has a marked effect upon the life of the cable. If brakes are not properly adjusted and stop the car too quickly the cables are subjected to unnecessary strains. Also, if the car is allowed to slide, wear and tear on the cables is increased. Finally, cables must be properly lubricated in order to prevent or minimize wear between strands and between wires in the strand.

M. V. MILLER, *Indianapolis, Ind.*

WEEKLY inspections of all wire rope cables used on elevators, cranes, or hoists should be rigidly maintained. If more than five adjacent wires in any one strand within one rope lay are broken the rope should be replaced. An easy and effective way to detect broken wires is to pass a handful of cotton waste over the rope. Broken wires will pull threads.

The length of life of any wire rope used on the equipment mentioned above is difficult to predict because it depends upon a number of factors, principally:

Time under load
Size of load
Amount of swinging
Frequency of travel under load
Atmospheric conditions
Temperature conditions
Lubrication
Length of idle periods
Ratio of drum diameter to rope diameter
Number of bends in rope
Reverse bends due to method of reeving
Factor of safety used

Roughly the life of a wire rope is in direct ratio to the hours a day that it is in actual use.

When replacing a wire rope always be absolutely certain that a rope with exactly the same specifications as the original rope is obtained. This refers both to the nature of the material and the type of stranding. If any substitution is made it should be recommended by the manufacturer of the equipment. In most cases it is best to secure cables from the original supplier of the machine. If the original rope does not give reasonable length of life this fact should be brought to the attention of the equipment manufacturer, together with complete data concerning the installation.

An article in the February, 1933, issue of this publication covered this subject in more detail.

C. E. SCHIRMER, *Chief Engineer*
*Hoist & Crane Division*
*Robbins & Myers Sales, Inc.*
*Springfield, Ohio*

## Locating Faults in Lead-Sheath Cable

*An insulation resistance test on a section of 7,500-volt, three-phase, lead-sheath cable that has been out of service for some time shows very low resistance between two of the conductors and between these conductors and the sheath. This piece of cable is about 700 ft. long. We want to avoid replacing all of it, if possible, and I should like to know whether there is any way of locating the defects, without destroying the cable.* *L.W.—Chicago, Ill.*

SIZE of conductors, type or thickness of the insulation, and the age of the cable are not given. Since these have a direct bearing on the treatment needed to put the cable back into operating condition it is difficult to give exact directions.

The low resistance between conductors and between conductors and sheath is not a definite indication that the cable is in unsafe operating condition. If the proper means are available current can be sent through the cable to dry out the insulation to a certain extent, care being taken not to allow the safe temperature to be exceeded. The temperature limit will depend upon the type of insulation, whether rubber, paper, or varnished cambric. The manufacturer of the cable will furnish this information.

Standardization rules give maximum safe limiting temperature as follows:

Impregnated paper, (85-$E$) deg. C.
Varnished cambric, (75-$E$) deg. C.
Rubber, (60-0.25 $E$) deg. C.

Where $E$ represents the operating voltage in thousands of volts (kilovolts). Safe limiting temperatures at 7,500 volts (7.5 kv.) working pressure would therefore be:

Impregnated paper, 77.5 deg. C.
Varnished cambric, 67.5 deg. C.
Rubber, 58.13 deg. C.

The actual safe temperature for drying out a cable might be higher than the foregoing, but recommendation for its use should be obtained from the manufacturer.

When a cable has been dried out, voltage can be put on it. It would be advisable to raise the voltage gradually, say at the rate of 1,000 volts a minute, since the cable has not been in service for some time. I know of cables that have been handled in this way and put

into service without any further drying out.

Regardless of whether the insulation resistance is high or low, no cable can be depended upon without some kind of a voltage test, preferably higher than the normal operating value. Just how much higher the voltage should be cannot be stated definitely since the age of the cable is not given. A common procedure involves testing the cable at twice its normal operating voltage at the time of installation, followed by testing at periodic intervals, not greater than 12 months, with 1.5 times normal voltage.

C. O. VON DANNENBERG
*Brooklyn, N. Y.*

### How Demagnetize a Screw Machine?

*A screw machine used for fine work has become magnetized and efforts to correct the trouble have not succeeded. First, a coil of wire containing about 200 turns of No. 10 wire was connected across 110 volts d.c., with a resistance for reducing the current from 15 amp. to 1 amp. At each current value the polarity was reversed. This method left more magnetism in the machine than it had before. Next, the same coil was energized with 110 volts, a.c., starting at 15 amp. and reducing the current to about ½ amp. The coil was slipped over the arbor that holds the steel to be worked. This method also failed. Finally, the machine was dismantled and an attempt made to demagnetize the parts with a growler. When the machine was assembled again it still retained enough magnetism to make it impossible to cut threads without damaging the work.*

*Can readers tell me how this machine can be demagnetized? Why did the methods we have tried fail?*

*F.W.—Springfield, Ohio.*

I BELIEVE that if the alignment of screw machine is checked with a compass it will be found that it is pointing almost directly toward the magnetic poles of the earth. If this is the case I advise relocating the machine at a right angle, or practically so, to its present position. Then the magnetism probably can be removed by the use of a coil energized with alternating current, as in the previous attempt.

If the machine does not point towards the magnetic poles of the earth, tapping with a brass or lead hammer will tend to reduce the magnetism, although if it does point towards the poles tapping will tend to magnetize it.

Possibility that the trouble may be caused by the proximity to a direct-current generator should not be overlooked.

GRADY H. EMERSON
*Manager, Emerson Electric Company*
*Birmingham, Ala.*

## ANSWERS WANTED

### Why This Commutator Connection?

*I notice that the commutator segments of a Delco model 3277, ¼-hp., 110/220-volt, 1,765-r.p.m., repulsion-induction motor are each cross-connected to a segment directly opposite, or 180 deg. around the commutator. Will some reader give me the reason for this method of connection? What would be the effect on the performance of the motor if these cross-connections were left out when the motor is rewound?*

*L.W.—Cape Girardeau, Mo.*

### Clearing Grounds in Cable Line

*An underground line consisting of three, single-conductor lead sheath cables in iron conduit supplies power at 550 volts to a wood stacker. The line is about ½ mile long with plugging boxes spaced 300 feet apart. It is always submerged in the springtime and we experience much trouble with grounds and shorts, which must be cleared as soon as possible. How should I go about locating the faulty sections between plugging boxes, and smoking out the defects?*

*L.G.D.—Northampton, Mass.*

### Instruments Needed by Maintenance Department

*I wish that other readers would give me a list of the electrical and mechanical instruments and testing devices which they think are necessary for our maintenance department to have in inspecting equipment and diagnosing troubles. We operate a wood- and metal-working plant containing about 450 motors, mostly three-phase a.c., fractional to 50 hp., with twenty 10- to 25-hp. d.c. motors. Sixty per cent of our machines are driven from lineshafts, with the remainder on individual motor drives. Power is purchased, but we have a boiler plant for heating and process steam, which contains several pumps and two air compressors. We do most of our own rewinding.*

*M.R.E.—St. Louis, Mo.*

### Floor Cold, Ceiling Hot

*The wall-type radiators in some of our departments were mounted about 2 ft. below the ceiling, which is 12 ft. high. The departments are 125 ft. long and 60 ft. wide. In cold weather the temperature for about 2ft. above the floor is much too low for comfort, although the air within a few feet of the ceiling is hot. To relocate the radiators close to the floor would cost considerable; furthermore, we should like to keep the walls clear, if possible. What would be the cheapest and most satisfactory way of securing a reasonably uniform temperature from floor to ceiling?*

*G.B.—Boston, Mass.*

THE CONDITION mentioned could be overcome by the use of a unit heater which has been developed for such service. This type of unit heater is made to such dimensions that in the majority of instances it can be installed in the place of a ceiling radiator, with minimum cutting of pipes.

Where maximum economy is desired, a thermostat mounted 2 or 3 feet from the floor may be used to start and stop the unit heater fan. When the fans are not running circulation will be caused by gravity. If required, the operation of the fan will cause the heated air to reach the floor. In the event that the inverted mounting, which enables the unit to project air discharged by the fan to the floor, is not satisfactory the unit could be mounted in what is termed the "ceiling mounting" and a small duct run close to the floor. However, if the units are properly selected and installed the action of the fan will tend to cause the warmer air to approach a lower level. In numerous instances the duct running to the floor is desirable, but if the inverted mounting is used the wall may be left unobstructed, provided the piping is not so close to the ceiling as to prevent mounting in this manner.

D. N. CROSTHWAIT
*Technical Advisor*
*C. A. Dunham Company*
*Marshalltown, Iowa*

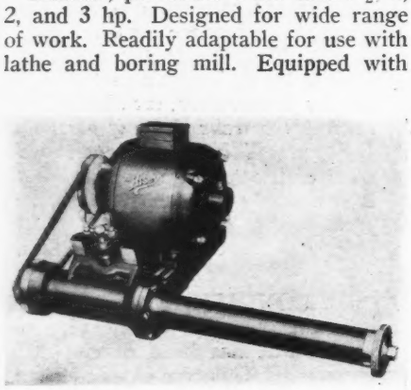
# ·EQUIPMENT NEWS·

## Engine

Light-weight, four-cycle, diesel. For either mobile or stationary service. Available in sizes of one, two, three, four, and six cylinders with capacities of 10, 20, 30, 40, and 60 brake hp. Cylinder size is 4¼x6 in.; normal operating speed, 1,200 r.p.m.; displacement 85 cu.in. per cylinder and 5,370 cu.in. per min. per hp. at rated speed. Available equipped with a.c. or d.c. generators in capacities of 6 to 40 kw. for electric generating service. Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago.

## Grinders

Internal, precision. Four sizes: ½, 1, 2, and 3 hp. Designed for wide range of work. Readily adaptable for use with lathe and boring mill. Equipped with



constant-speed motors. Dovetail slide with screw feed and handle for rapid adjustment of wheel to center of work. Rotation of wheel reversible through motor. V-belt drive. The Hisey-Wolf Machine Co., Cincinnati.

## Thermometer

Recording, Model "500." Has 6-in. calibrated chart. Made in both portable and wall-mounting types. Element consists of bulb, capillary tube, and Bourdon tube filled with special liquid. Instrument is compensated for temperature variations and is unaffected by altitude. Made in variety of ranges and subdivisions. Case dimensions, 7¼x7x 2¾ in. Moto Meter Gauge & Equipment Corp., La Crosse, Wis.

## Elevating Trucks

"Hi-Lift Stevedor" and "Lo-Lift Stevedor." Former has hoist which enables platform load to be raised 6 ft. for tiering or double decking. Will handle loads over 50 ft. long. "Lo-Lift" not suitable for double decking but will handle either long or high loads. Both types have four-cylinder gasoline engines equipped with two-speed forward and two-speed reverse transmission. Speeds up to 18 miles per hour, loaded to capacity of 3 tons. Various platform widths and lengths. The Ross Carrier Co., Benton Harbor, Mich.

## Compressor

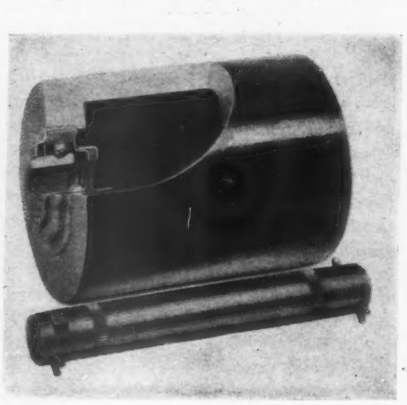
Air and gas, "Type XVG," direct-connected, gas-engine driven. Units consist of vertical four-cycle, multi-cylinder, "V"-type gas engine with direct-connected standard I-R horizontal compressor cylinders. Shipped completely assembled. Four sizes, 60-, 125-, 190-, and 260-hp., with two, four, six, and eight power cylinders, respectively; two power cylinders for each compressor cylinder. Ingersoll-Rand Co., Phillipsburg, N. J.

## Welding Electrode

For building up steel surfaces to resist shock and abrasion. Called "Wear-weld." Deposits air-hardening alloy steel. Can be used with all steels other than austenitic type. Single layer on mild steel has hardness of 40-45 Rockwell C. On 0.70 carbon steel, single layer has hardness of 50-55 Rockwell C. Heavy coating of electrode provides shielded arc, layer of slag. Two sizes: ¼- and ⅝-in. diameters, 18-in. lengths. The Lincoln Electric Co., Cleveland.

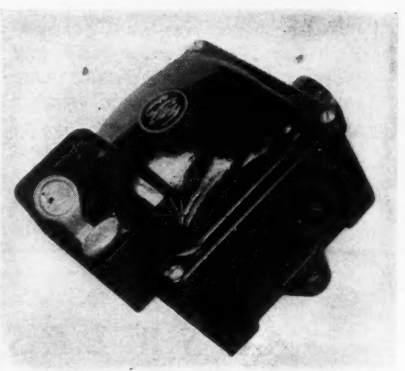
## Conveyor Roller

Ball bearing. For use on gravity, roller, and power-driven conveyors. Three heavy-duty types; 100B is 7⅝ in. in diameter, and has continuous load rating of 8,000 lb. per roller; 56-A is



3⅝ in. in diameter and has continuous load rating of 2,000 lb. per roller; Type 100B has labyrinth-seal-protected and pressure-lubricated bearings; also, patented gearlock axle which locks inner race of bearings and axle so that race cannot rotate on axle and cause wear between parts. Type 56-A can be furnished with labyrinth-seal-protected bearings and patented gearlock and keylock axle, or without labyrinth seal. Matthews Conveyor Co., Ellwood City, Pa.

## Pushbutton



Vapor-proof, dust-tight, safety-lock-out. For use in connection with remote control of automatic motor starter. No. 270-A, Type J, Form C. For three-wire, low-voltage protection installations, where it is desired to start and stop a motor through its magnetically operated starter or controller from two or more pushbutton control stations. The Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland.

## Liquid Level Control

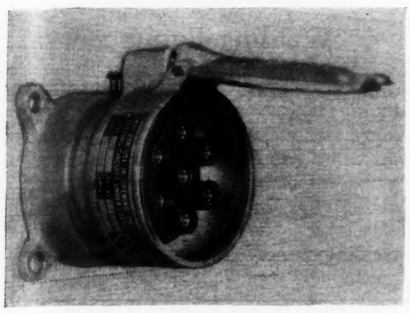
Remote, ball bearing. For controlling level of liquid in tanks, condensers, receivers and other vessels. Float chamber equipped with stainless-steel balls and races. Will operate valves at any distance up to 300 ft. Construction permits pressures up to 450 lb. Operating mechanism fully inclosed, but accessible for adjustment. Grease-sealed stuffing box optional. The Swartwout Co., 18511 Euclid Ave., Cleveland.

## Motors

Fractional horsepower. Type FS is polyphase, squirrel cage, for all voltages and frequencies, two- and three-phase, ⅛- to ¾-hp. rating. Type FR is repulsion-start induction motor for

high-torque, constant-speed service. Rated for single-phase, 110- and 220-volt service. Type FK shunt, compound, and series-wound d.c. motors are rated for 32-, 115- and 230-volt, 1/30- to ¾-hp. service. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

## Receptacle



Heavy-duty, multi-contact. For use in connection with Metal-Clad Switchgear and control equipment. Can be bolted flat against opening in metal housings inclosing control wiring, giving direct connection with minimum space requirements. Made in 3, 4, 5, 6, or 7 poles. All except the three-pole are polarized. Delta Star Electric Co., 2400 Block, Fulton St., Chicago.

## Ventilator

Rotary. Moves only with change of wind direction. Has bronze ball bearings. Outlet opening 30 per cent greater than inlet opening. Outside adjustable louvers, dampers, and operating mechanism. Constructed of heavy-gage Armco ingot iron; also furnished in copper, aluminum copper, or special materials. All joints double-seamed. Sizes from 10 to 72 in. Shipped completely assembled. The Swartwout Co., 18511 Euclid Ave., Cleveland.

## Dry Cell

No. 6. Has all-zinc, soldered shell-top, bottom, and sides. Top becomes active material. Leak-proof. Hermetically sealed. Solid fibre, paraffin-impregnated washer, self-aligning, insulates positive from negative terminal. Bond Electric Corp., Jersey City, N. J.

## Time Starters

Non-reversing, magnetic. Designed for remote control of constant- and adjustable-speed d.c. motors in sizes up to 10 hp., 115 volts, and 20 hp., 230 and 550 volts. Provide two points of magnetic time-limit acceleration on motors of 10 hp. and below, three points of acceleration on 15- and 20-hp. motors. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

## Signal Call Device

For code-calling use in industrial plants in connection with horns, bells, and sirens. Located at switchboard and connected into signal system, device provides 30 separate codes. Operation consists of setting dial and pushing down plunger. Each code repeated three times, automatically, by one setting of dial. Furnished with cord and connector, ready to install. Federal Electric Co., 8700 South State St., Chicago.

## Caster Wheel

Light duty "End-Wood." Built up of wedges cut from hard Northern maple. Waterproof and weatherproof. No rivets or metal used in construction. Diameters from 2½ to 10 in. inclusive. Any thickness of face, hub-length, and bore for axle supplied without extra charge. The Metzgar Co., Grand Rapids, Mich.

## Gas Furnace

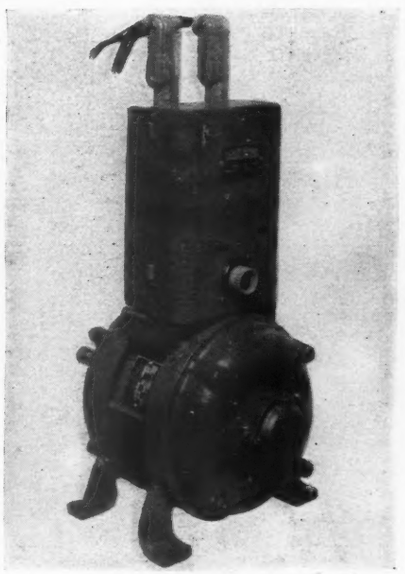
Series CK, for commercial installations where total boiler load ranges from 475,000 to 2,333,000 B.t.u. per hr. Available for steam, vapor, or gravity hot-water systems. Cast-iron sectional boilers, sectional arrangement of burners, and standardized control. Increased size and capacity obtained by adding boiler sections and burners, and by increasing size of gas-regulating and control valves. Fully automatic in operation. General Electric Co., Schenectady, N. Y.

## Relay

Supersensitive. Known as Model 705. Claimed to make contact on 3 microamperes or 1 millivolt, and that contacts are capable of handling 5 watts at 110 volts, non-inductive load. May be calibrated for almost any scale range. May be used as over-voltage or over-current alarm, or under-voltage or under-current alarm, or both. Available with two contacts instead of one. Contacts may be reset manually or automatically. Relay is 3¼ in. in diameter, with flush- or surface-mounting case. Weston Electrical Instrument Corp., Newark, N. J.

## Motor

Self-protected. Manufacturer claims it cannot burn out. Protective device built into winding shuts off current if



motor stalls or becomes too hot. Sizes from ½ to 30 hp., a.c., induction, for either two- or three-phase, and standard commercial cycles and voltages. Controls mounted on motors. The Lincoln Electric Co., Cleveland.

## Welder

Universal, truck-mounted, 40-volt, 200- or 300-amp., shunt-inductor type. Operates through power take-off on any 1½-ton truck whose engine speed is 1,800 r.p.m., engine displacement 215 cu.in. or better. Davey air compressor, 140-, 160- or 240-cu.ft. capacity, also part of unit. Welding generator interlocked through Ditwiler power take-off with engine governor to hold welding generator at constant speed under load. Truck can be moved under own power only after power take-off has been disengaged. Universal Power Corp., 1719 Clarkstone Road, Cleveland.

## Recording Regulators

Known as "Fulscope," for controlling temperature, pressure, rate of flow, or liquid level. Universal sensitivity adjuster provides full-range sliding adjustment by which regulator performance can be balanced for any degree of apparatus time lag. Screw-driver adjustment on graduated dial gives

throttling or on-and-off diaphragm valve action. Regulator action can be converted from direct to reverse, or vice versa, without addition or subtraction of parts. Temperature or pressure regulators may be adapted to applications requiring different temperature or pressure range by substituting tube system and chart with required range. Die-cast aluminum case supplied for face-mounting or flush-mounting. Warren Telechron electric chart-driving mechanism is standard equipment; spring-driven mechanism optional. Taylor Instrument Companies, Rochester, N. Y.

## Fuses

"Super-Lag." Designed to prevent blowout until current overload has continued for sufficient time to be dangerous. Renewable. Made in all standard ratings in both knife-blade and ferrule types. Jefferson Electric Co., Bellwood, Ill.

## Crane

General utility. Called "Hustler." For handling materials and industrial equipment, logs and pipe. Has two side drums and a front drum, all of which rotate independently. Each drum has three forward speeds and one reverse speed. Live, power-driven boom can be attached to either side of tractor. Tractor has high speed of 5.2 m.p.h., intermediate speed of 2.6, and low speed of 1.3 m.p.h. Carrying power with counterweight, 12,000 lb.; without counterweight, 5,200 lb.; with detachable stiff-leg under boom, 35,000 lb. The Harnischfeger Corp., Milwaukee, Wis.

## Correction

In an item entitled "Belts," on page 150 of the March, 1934, number, describing "Monobelt," an error occurred. The third sentence, "Made of vegetable-tanned leather, pre-stitched," should have read, "Made of vegetable-tanned leather, pre-stretched." Product of Alexander Brothers, Inc., 406 N. Third St., Philadelphia, Pa.

## Coupling

Designed to take care of misalignment. Called "Flex-Align." Claimed to be self-aligning, vibration-absorbing, and universally flexible. Has rubberized fabric driving members. Will run in either direction without back-lash. Baldor Electric Co., 4357 Duncan Ave., St. Louis, Mo.

## Welding Equipment

Spot and projection. For manual or motor operation. Has heat-resisting-alloy electrode tips. Current is turned on after pressure has been applied to work, off before pressure is released, to avoid spattering of molten metal. Mechanical switch controls duration of welding time. Transformer is single-phase, shell-type, air-cooled unit. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

# *TRADE LITERATURE*

AIR CONDITIONING, REFRIGERATION—Bulletin, "Servel Air Conditioning and Commercial Refrigeration Equipment."—Servel Sales, Inc., Evansville, Ind.

AIR CONDITIONING — Bulletin No. 101, "Clarage Vortex Control." — Clarage Fan Co., Kalamazoo, Mich.

AIR CONDITIONING, REFRIGERATION — Catalog, illustrating equipment. — Servel Sales, Inc., Evansville, Ind.

AIR HANDLING, CONDITIONING — General Catalog, Second Edition, "Clarage Air Handling and Conditioning Equipment."—Clarage Fan Co., Kalamazoo, Mich.

ALLOYS — Folder, "Amsco Alloy." — American Manganese Steel Co., 6600 Ridge Ave., St. Louis, Mo.

CABLE — Booklet, "Installing General Cable Trenchlay." — General Cable Corp., 420 Lexington Ave., New York.

CIRCUIT BREAKERS — Catalog 33-200, covers complete line of oil circuit breakers up to 50,000 kva.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS—Bulletin 1165, "Bracket Bearing Synchronous Motors." — Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CONTROL — Booklet, "Supervisory Control, Visicode and Audicode 2-Wire Systems."—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS—Bulletin No. 509-A, illustrates, describes construction, operation, uses of Frequency Converters; Bulletin No. 502-B, illustrates and describes Inverted Rotary Converters. — The Louis Allis Co., Milwaukee, Wis.

CONVEYOR—Catalog pages B37, 38, 39, 40, 43, 44, illustrating and describing Mathews Heavy Duty Roller Conveyors.—Mathews Conveyor Co., Ellwood City, Pa.

COUPLING — Bulletin No. 24, "Baldor 'Flex-Align' Coupling." — Baldor Electric Co., Apparatus Dept., 4357 Duncan Ave., St. Louis, Mo.

ELECTRIC HEAT — Catalog 34, "Chromalox—The Right Heat . . When and Where You Want It."—Edwin L. Wiegand Co., Pittsburgh, Pa.

ELECTRIC HEAT — Catalog GES-787B, "Electric Heating Units and Devices."—General Electric Co., Schenectady, N. Y.

GAS — Bulletin No. 38, "A New and Better Fuel for Internal Combustion Engines."—Philgas Co., General Motors Bldg., Detroit, Mich.

INSULATING MATERIAL—Catalog, "Micabond, a Bonded Mica Insulating Material." —Continental-Diamond Fibre Co., Newark, Del.

INSTRUMENTS—Bulletin, "A Triumph of Scientific Research—Taylor 'Fulscope' Recording Regulators."—Taylor Instrument Companies, Rochester, N. Y.

LIGHT METER — Catalog Section 43-750, "Right Light Meter, A New Light Measuring Instrument."—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LUBRICATION—Bulletin No. 102F, "The Lubrication of Small Mechanical Devices." —Acheson Oildag Co., 654 Madison Ave., New York.

MATERIAL HANDLING — Folder, "Bulk Handling by Belt," shows applications of REX-Stearns Timken Idlers.—Chain Belt Co., Milwaukee, Wis.

MECHANICAL HANDLING — Engineering Data Book No. 1240, 64 pages, covers

*(Continued on advertising page 48)*

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## that increased the pulling power of belting 25 to 40%

NATURE—in its infinite wisdom—designed your fingers to *grip*. That's why they grip better than the smooth skin on the rest of your body.

Non-skid tires use the same fundamental principle—that's why they grip better than smooth tires.

Now this "non-skid" principle has been applied to

**VIM TRED LEATHER BELTING**

and actual tests prove that it GRIPS 25% to 40% better than smooth belting.

Here's what this EXTRA GRIP means to you:

1. Less loss of power through belt slip.
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VIM TRED Leather Belting is designed to give you more efficient power transmission at lower cost. Put a VIM TRED Belt on any drive in your plant and let it prove to your satisfaction that it will banish your belt worries and reduce your belt costs.

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Send this coupon for an ACTUAL SAMPLE FREE and an interesting booklet which shows how VIM TRED Leather Belting will reduce your belt costs.

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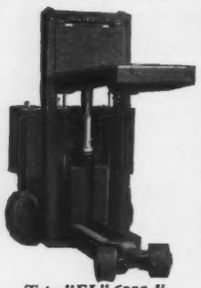
# IMPORTANT SAVINGS

## MAY LIE RIGHT UNDER YOUR HAND . . .

A review of material handling methods and equipment in the light of present-day operating requirements offers a definite opportunity in many industrial plants. In the coming months more than ever before profits will lie in cutting costs; modern material handling equipment correctly applied to today's needs offers substantial savings, easily and quickly obtained. The experienced Mercury organization is at your service with authoritative data on methods and equipment.



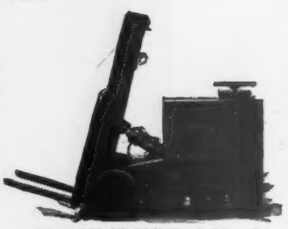
*Type "EL" 6000 lb. lift truck*

**LIFT TRUCKS**

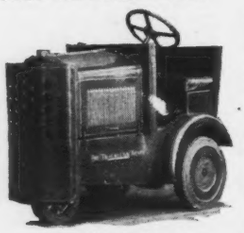
Platform lift trucks, Type "EL" 6000 lb. capacity, Junior Type "JL" 3200 lb. capacity, in both standard and special low lift, high lift, and telescopic high lift models, for all types of skid handling operations. Exclusive Mercury features make these the outstanding, modern lift trucks. Bulletin 155.

**FORK TRUCKS**

Outboard lift Type "T.T.T." fork trucks available in tilting, non-tilting, high lift, and telescopic high lift models, with hydraulic tin plate clamp, ram, chisel, or any variation of forks for pallet handling. Capacities 2500 to 5500 lbs. Bulletin 165.



*Type "T. T. T." Fork Truck*



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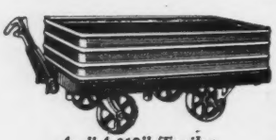
A full line of gasoline and electric powered tractors adapted to all requirements of industrial plant hauling is offered, backed by over 20 years of experience in the application of the tractor-trailer method of material handling. Bulletins 106, 114, 150, 160.



*An "A-310" Trailer*

**TRAILERS**

Caster steer, fifth wheel, spring suspended, and other types, in the widest range of standard and special models, capacities from 1000 lbs. to 7 tons, are available for the efficient handling of any kind of goods. Over 200 variations of the standardized Type "A-310" trailer have been developed and built, and are available to meet individual requirements. Bulletin 160.

***Recommendations of suitable equipment and methods of operation to meet individual requirements will be made without obligation.***

MERCURY MANUFACTURING COMPANY
4110 South Halsted Street : : CHICAGO, ILLINOIS

# MERCURY

TRACTORS . . . TRAILERS
LIFT TRUCKS

•

ORIGINATORS OF "THE TRACKLESS TRAIN" Method of Material Handling


## Couldn't Raise Prices, So—

*(Continued from editorial page 154)*

be, via a short double-decked roller conveyor to (d) the bed machine operators, who complete the operation by lasting the toe and heel of the shoe. The rights and lefts come together again on the lower section of this conveyor, and the unit's work is completed, when (e) a boy —one for every three teams—pulls the tack at the back seam and places the pairs on a rack ready to be moved to the next group operation.

The teaming method, it has been seen, takes the walking out of the job for everyone except the assemblers, who have plenty of time to move the work to the unit and still assemble enough uppers to the lasts to keep the puller and the lasters busy. It is this teaming, made possible by the conveyor method, which is chiefly responsible for the stepping up of production to its present figure.

Shoes are now on racks, ready to be moved via elevator to the Compo process on the next lower floor, where the group system is again in use, with a belt conveyor this time to move the work through the unit. There are three units, each able to handle 2,400 pairs.

### Handling Done by Lowest Paid Operator

Again the first job is the lowest paid. Again the first operator, a girl, has time enough on her hands to move the rack of shoes over to the unit. This done, she (a) marks the shanks as a guide to rough to, and passes the shoes to the belt conveyor which moves them to (b) the two roughers who remove the finish from the lasting allowance of upper stock around the forepart and at the shank so that the cement will penetrate; then (c) one operator tacks in the steel shank piece; after which three cementers (d) apply the special cement that is used, wiping off the surplus with the felt filler used to level the bottom of the shoes, then using that same surplus cement to stick the filler in place.

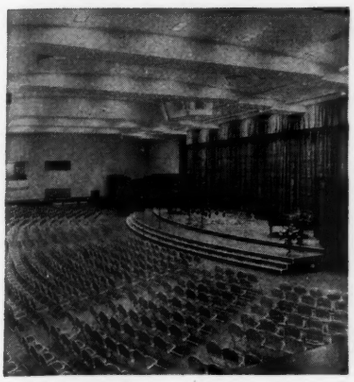
At the end of this belt conveyor—and at the end of belt conveyors used later on in the progress of the shoes—there is a cup, incidentally. If shoes begin to come along too fast, one drops in and stops the belt.

After cementing, the shoes are (e) inspected, placed on racks, and moved by the operator at the end of the belt to the conditioner where the cement is thoroughly dried. This conditioning has the further effect of taking any remaining moisture out of the upper and shrinking it still tighter to the last. Thus the upper is first pulled to the wood mechanically, then finally shrunk to it, assuring thereby close adherence to the actual lines of the last. Now that the upper is securely cemented over the edges and to the bottom of the insole, the tacks that have held the upper in place may be pulled.

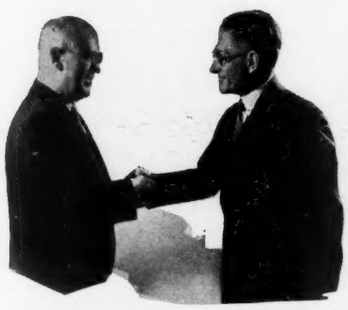
Shoes are now ready to have the outsoles cemented to the uppers. Again, a conveyor is tied so intimately into the process that it is essentially a part of it. Again the handling from the conditioner to the cementing unit is done by the first man in the line, a man who has plenty of time to do it in conjunction with his actual work on the shoes.

Here are two double-decked belt conveyors, each serving two Compo cementing units. The first operator—the one with the least to do—gets the rack of shoes from the drier, tacks on the soles, passes shoes to the con-

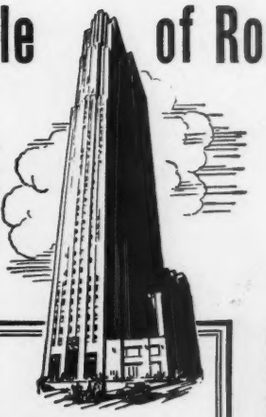
# Controlling the unseen miracle of Rockefeller Center with 429 *Taylor* INSTRUMENTS



**N B C STUDIOS** are airtight—soundproof. Each receives a complete change of mountain-fresh scientifically conditioned air every eight minutes. The one shown here is 3 stories high, the largest in the world.



**CONGRATULATIONS!** Mr. A. C. Buensod of the Carrier Engineering Corporation and Mr. E. C. Taylor of Taylor Instrument Companies exchange greetings on completion of this million-dollar air conditioning plant—the most intricate and elaborate ever built.



**LARGEST UNIT** of this "city within a city," the R. C. A. Building, where Taylor Engineers have installed one of the world's largest systems of temperature control for the National Broadcasting Company.

*Carrier and Taylor Engineers Solve Baffling Temperature Control Problem—Weather To Order for N B C Broadcasting Studios and Offices—A Centralized Control That is Almost Human—How It Helps Radio Stars Do Better Work—Makes Shopping More Pleasant in World's Largest Office Building.*

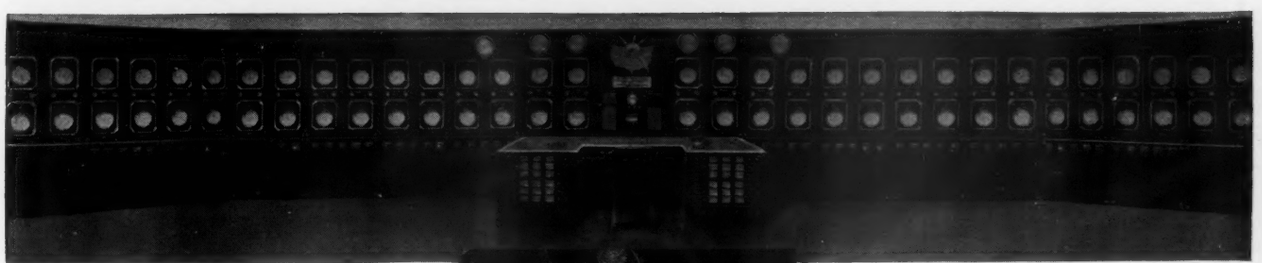
**Taylor**

Indicating / Recording • Controlling

**TEMPERATURE *and* PRESSURE INSTRUMENTS**

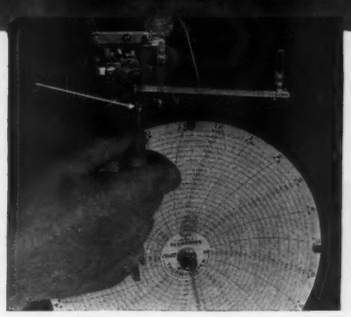
The name Taylor now identifies our complete line of products, including Tycos instruments.

**SUMMER HEAT,** or freezing cold outside, but the weather in R. C. A. Building shops is always just right. A unit of 29 Taylor Recording Regulators provides the same precise temperature control here as in N B C studios.



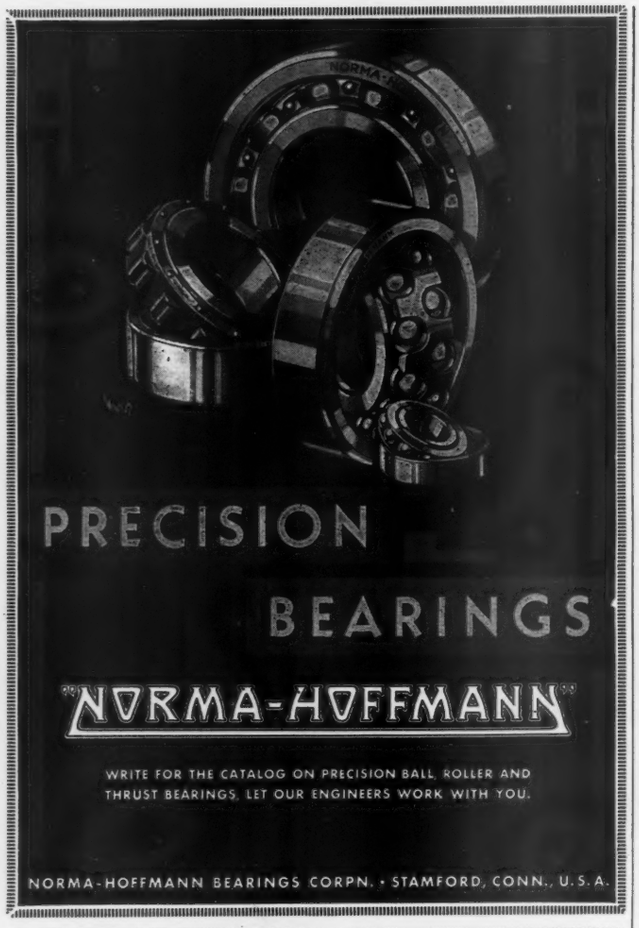
(*Above*)

**HEART OF THE SYSTEM**—The Control Room where these 64 Sentinels of N B C Weather stand guard. 93 Taylor Recording Regulators provide individual temperature control for N B C broadcasting studios and offices and R. C. A. Building's retail shops, maintaining the desired air conditions within ±½° or 1° overall. This mammoth installation required 250 Taylor Industrial Thermometers, 104 Taylor Even-Action Valves, 37 Type P Air Operated Thermostats and over 6 miles of tubing.



(*Left*)

**EIGHT MAJOR IMPROVEMENTS** in the new Taylor "Fulscope" Regulator—a degree of accuracy and efficiency in temperature and pressure control never before obtainable. As illustration shows, a turn of the screwdriver quickly sets adjuster to the *one best sensitivity* for a particular process. For details, write the Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.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WRITE FOR THE CATALOG ON PRECISION BALL, ROLLER AND THRUST BEARINGS. LET OUR ENGINEERS WORK WITH YOU.
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**Every Kind of**

**STEEL**

**[also Copper & Brass]**

**In Stock For Immediate Shipment**

**Hot rolled bars.**
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**RYERSON**

veyor, the upper belt feeding one Compo machine, the lower feeding the other.

The Compo operator now takes a shoe from the conveyor, brushes a solvent on the cement that has previously been dried on the upper and on the sole, and places the shoe in the Compo machine.

This machine is really an endless conveyor made up of a series of jacks. The upper element of each jack holds the shoe; the lower is a leather cushion with a rubber bladder inside. Air is introduced into the bladder at 45 pounds pressure and the outer sole is pressed to the insole and upper. As the shoe makes the circuit of the machine, the cementing operation is completed; and as one shoe goes on, another comes off, is placed back on the conveyor, and taken down to have the heel seats cut. The wood heels have, incidentally, been sent along with the shoes through this operation.

At the end of the belt, shoes are racked again and moved to two heeling units where first the heel is fastened to the shoe with a screw clamp. Later on, after the lasts have been pulled, this clamp is withdrawn and the heel is nailed through the heel seat and permanently affixed.

The remaining operations on the heel are connected by small sections of gravity roller conveyors such as we have seen in the lasting units. Conveyors of the roller variety are also used in the department where wood heels are covered and made ready for the shoes to which they belong. The results there are two compact, efficient layouts, where manual handling is held to the absolute minimum.

Further evidence of the efficacy of conveyorization is found in the bottom finishing department which is done one floor below the cementing units.

### Work on the Group Plan

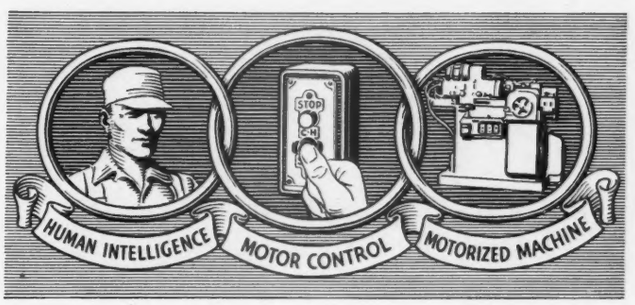
Again the work is done on the group plan with connecting conveyors. There are two edge-trimming and edge-setting units for Compo shoes and a third which handles both Compo and welt shoes. The units consist of four men each. The first trimmer does the right shoes and sends the left to the second trimmer via the upper deck of the roller conveyor. Each places the trimmed shoe on the lower section, which leads to the wetter. The latter wets the edges, and places the shoes on a rack adjacent to the first edge-setting machine. This operator sets the edges and in turn places shoes on another rack on his other side. Here two girls ink the edges and place shoes in a vertical drier. When they come down, they are ready for the second setting, after which they are placed on the upper belt of a double-decked conveyor whose lower belt takes shoes away from the other edge-cutting unit. At the end of the belts, after a minor operation or two, the shoes move down two roller conveyors, to a wide power-driven slat conveyor, from which various sanding operations are conveniently performed. The men work in teams, one on each side of the conveyor. Shoes are removed at the end of the slat conveyor, the bottoms are painted, and again the shoes are racked to go through a mechanical drier.

When they emerge from the drier, they move back down the room on another slat conveyor through the various bottom-finishing operations. The men work in teams as usual; one does the lefts, the other the rights. Here the screw clamps are removed and the heels nailed

# LINKING TRAINS brings *SPEED* with *SAFETY*

MOVING units, whether they are railroad trains or machines in Industry, must be linked to human intelligence. Modern railroading depends on communication for fast, accurate control. In Industry the *vital* link is Motor Control.

Being the *vital* link in the mastery of man over machines, Motor Control is far more important than either its size or cost indicates. It is a factor in the speed and dependability of production, the quality of workmanship, the cost of power and maintenance, the safety of men, motors and machines.



**Make Your Next Breakdown a Test Case**

*Don't take anyone's word for the importance of Motor Control. Prove it yourself. Select a machine that chronically upsets production. Ask a C-H engineer to recommend correct Motor Control. Let results . . . fewer breakdowns, speedier operation, lower maintenance show you the importance of Motor Control throughout your plant. Call in Cutler-Hammer and uncover savings for years to come.*

Be sure your plant appreciates the importance of Motor Control. Plants which do, usually specify Cutler-Hammer Motor Control for every motor or motorized machine. Motor builders recommend it. Leading machinery builders feature it. Independent electrical wholesalers stock it for your convenience. CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus,* 1206 St. Paul Ave., Milwaukee, Wis.

NRA WE DO OUR PART

**CUTLER HAMMER**

C-H

***The Control Equipment Good Electric Motors Deserve***

(B-215)

on. Incidentally, just one man in each of the groups described keeps track of the case numbers of the lots worked on. This simplifies the paperwork both for the operators and for the payroll department.

The last operation in the bottom-finishing room is performed by boys who rub up the edges of the soles and remove the shoes to racks which take them to the packing room. Even here conveyors move the work to operators and take it away again. Six belt conveyors in pairs serve the treers, four treers to a belt. At the end of the belt a girl singes off loose threads, racks the shoes and moves them to two double-decked belt conveyors which carry them through various repairing and dressing operations. Finally the shoe is laced, if it is that kind of shoe—or the buckle is attached, and so on. Which leaves nothing to do but pack them in the cartons.

Results, so far as manufacturing expense is concerned, have been cited. Summed up in a single statement, they have enabled this concern to turn out better shoes which its retail stores can sell at prices today's consumer is willing and able to pay—all this in the face of rising labor and material costs. The results may be attributed in part to the company's foresight in changing over the bulk of its production to a newer and better process, in part to the skill with which the principle of conveyorization has been tied into the process. Conveyors have been used by the Smiths merely to take the fits and starts out of the production flow, thereby leaving the worker free to exercise the skills which he has been hired to perform. Mechanical handling viewed from this angle becomes, not an end in itself, but a means to an end. The end, naturally, is a better product at lower cost.

## Getting Maintenance Costs

*(Continued from editorial page 183)*

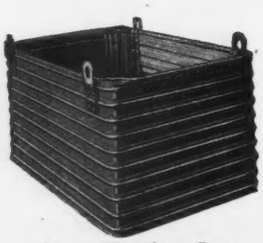
material costs. It will be noted that the shop order instructs the use of a *Material Used Daily Report* form which is to be omitted for the shop sub-order. This form, Figure 5, is the equivalent of a stockroom requisition where such item exists.

My company, like many other concerns, does not operate a stockroom for general maintenance supplies. When the specific advantages of a carefully controlled stockroom were considered in connection with the formulation of this system, it was admitted that our widespread storage requirements in conjunction with the added expense of personnel adequate to maintain the accuracy of such control, made its adoption impractical.

The "material used daily report" has been an effective substitute. It is executed by the workman, or strawboss, inspected and approved at the close of the day by the foreman, collected by the engineering office and referred to the purchasing department, where it is priced and thence returned to the engineering office. The danger of duplication of entries on large jobs extending over a period of time is canceled by observation of the rule that material is to be charged by the workman at the time it is withdrawn from stock or yard storage.

The only other complaint which can be seriously suggested against the use of this form is that of making clerks out of mechanics. This tendency has been reduced, however, to minor consideration by the utilization of the clerical services of the receiving department


# Handle Materials at Low Costs with Truscon Boxes and Platforms



Crane Handling Box

Skid Platform and Box Unit

Sectional Box and Platform

Skid Platform
Note the Patented Reinforcing Ribs.

Handle materials more efficiently, speed up production, save floor space and reduce your costs by adopting Truscon Steel Boxes and Skid Platforms. Designed for lift trucks and cranes and available in all types, sizes and combinations to meet individual requirements. Constructed of any gauge metal, heavily reinforced and practically indestructible under continuous, hard service. Our engineers will gladly study your plant conditions and make recommendations without obligation.

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6100 TRUSCON AVENUE, CLEVELAND, OHIO

**TRUSCON EQUIPMENT MEETS ALL REQUIREMENTS**

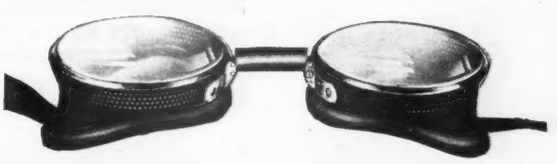
# You Pay FOR GOGGLES

## WHETHER YOU BUY THEM OR NOT

FROM a dollar-and-cents viewpoint, consider these facts: If a man loses his sight, the average compensation will be between $1800 and $3500. Even minor eye injuries cost more than the goggles that would have prevented the accidents.

The cost of eye protection in your plant is but a small fraction of the cost of accidents . . . and you pay for goggles whether you buy them or not. Modern goggle equipment covering practically every known eye hazard has been developed by the American Optical Company. These goggles are comfortable, accurately fitted to the man, the place and the job, and are an aid to quick, efficient work.

AO industrial specialists will be glad to recommend a practical eye safety program exactly fitted to the needs of your plant . . . a program that will assure you of a substantial return on a very modest investment. This service is available immediately through more than 200 branches of the American Optical Company in this country and Canada. Call upon us.



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THIS Company, for more than two decades, has been a leading manufacturer of air conditioning equipment. Clarage installations are many, and successful. We have had wide experience in this particular field.

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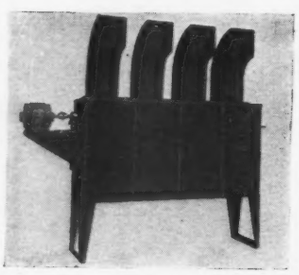
There is Clarage equipment available to meet any requirement from the simple comfort cooling job to completely air conditioning an office building or hospital, or providing controlled climate in industry to protect against production "lags," spoilage and high production costs.

When you bring your problem to this organization, you have placed it in expert and experienced hands. CLARAGE FAN COMPANY, Kalamazoo, Mich.

20-story Mutual Home Bldg., Dayton, completely air conditioned by Clarage systems.



Above: New Combination Unit Heater & Cooler—factory cooling made very inexpensive.

At right: Unit Air Conditioner providing both temperature and humidity control.

# CLARAGE
## AIR HANDLING AND CONDITIONING EQUIPMENT


in executing "material used daily reports" as a part of their normal routine of receiving and checking all shipments. It is accomplished by indicating on their purchase order copy the shop order number for which the material is intended, and by the use of a green tag which is thereupon attached by them to all lots of material so identified.

The green tag, Figure 6, not only acts as a signal to the maintenance workman that the material has already been reported by the receiving department, but also affords quicker and better identification from storage, and discourages "stealing" for another job. The net requirements for the engineering department by this provision are that the foreman whenever possible identifies on his purchase requisition all material applicable to a definite shop order, so that the workman is required to render a "material used daily report" only when material is withdrawn from general stock.

The return of unused material at the close of a job can be readily accounted for by employing the same form as a properly marked credit slip.

[The third and concluding part of the article, scheduled for May publication, tells of the use of the recorded data in making cost analyses by which to keep control of maintenance expenditures.—Ed.]

## Safety Says: Inclosed Switchgear

*(Continued from editorial page 176)*

rupting capacity often afford an economical means of protection, although oil circuit breakers are also largely used.

With the lower voltages, switch-houses are very useful. They may be used individually or lined up to form a continuous control equipment with through buses. The switch-house is in effect an outdoor cubicle, except that no equipment is mounted on the outside and bushings are provided for entrance of leads through the top. Hinged doors with provision for padlocking give entrance both front and rear, except in the smaller houses where only one door is used. A stationary steel panel in the smaller sizes and a hinged panel in the larger ones is provided for mounting the control, meter, and protective equipment. The oil circuit breaker is bolted to structural steel supports. In the larger houses an isolating barrier is placed between the high- and low-tension apparatus, separating also the breaker proper and its mechanism. It extends the full height and width of the house.

Any buses or disconnecting switches required are placed in a superstructure either of the open or inclosed type. Switches, in the open-type structure, are of the hook-operated, outdoor type. Buses are furnished separately and placed during installation. The inclosed type of superstructure is built as an individual part of the house, and disconnecting switches are usually group-operated, although hook-operated switches may be used. Buses for each unit are installed at the factory and bolted together with silver-surfaced splicing plates during installation.

Fire risk in all of the equipments described is low, particularly in the metal-clad gear, because inclosures assist in isolating fires starting within, and protect from external fires. No oil is used for insulation in the bus compartment and the danger from burning oil from oil circuit breakers is practically nil.

# UP_ go wages . . .

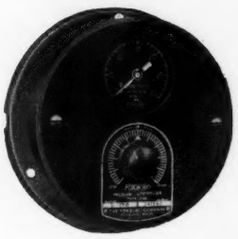
# UP_ *but*

# UP_ DOWN

# DOWN

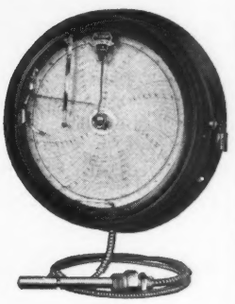
# DOWN

# Come Costs



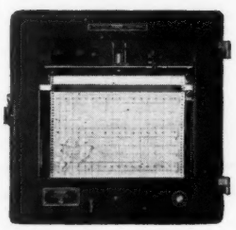
*Left:*

1119. This inexpensive Controller will create tremendous savings by automatically controlling driers, tanks, kettles, etc.



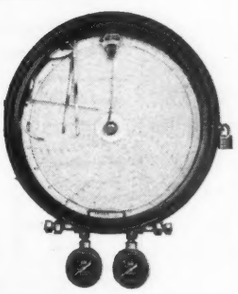
*Right:*

For immediate savings use Recording Thermometers. Their records quickly lead to elimination of wasteful methods.



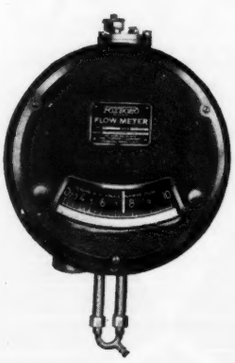
*Left:*

The Potentiometer Recorder assures highest possible quality on products processed at temperatures over 800°.



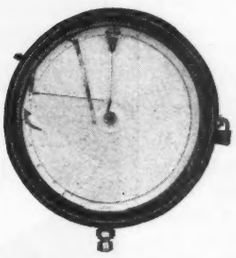
*Right:*

Recorder Controllers keep an accurate record of the process they control. It's two instruments in one.



*Left:*

Measurement of steam, water and air quickly lead to savings. This simple Indicating Flow Meter is just one of a complete line of Foxboro Meters.



*Right:*

What do incorrect pressures cost you? This Recording Pressure Gauge will tell you quickly and help you stop the loss.

## Modern Instruments are a timely answer to the problem of meeting higher production costs.

Under the new order the elimination of WASTE has become the answer to many a manufacturer's problem, and there's no quicker or cheaper method of cutting waste than through instrument control.

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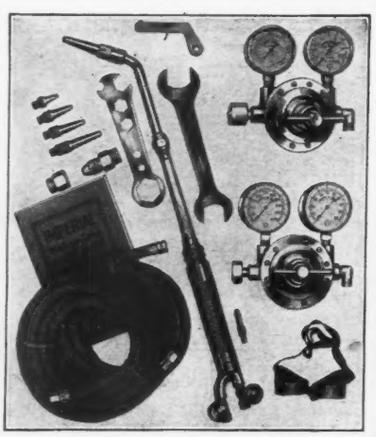

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*(Continued from editorial page 196)*

equipment for mechanical handling, screening, sizing, washing, dewatering, and preparation of sand, gravel, stone, and other non-metallic minerals.—Link-Belt Co., 910 S. Michigan Ave., Chicago.

METER—Folder, illustrates and describes Brown Electric Flow Meter.—The Brown Instrument Co., Philadelphia, Pa.

METERS — Catalog RA-34, "Hays Combustion Recorders." — The Hays Corp., Michigan City, Ind.

METERS—Folder, "Quality Products Deserve Fine Meters as Standard Equipment." — Russell Electric Co., 345 West Huron St., Chicago.

MONORAIL—Form G-134, "An Industrial Cross Section of Cleveland Tramrail Overhead Materials Transportation Equipment." —Cleveland Tramrail Division, The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MOTOR — Bulletin L. 20609, "Type CR Repulsion Start Induction Motors."—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS—Bulletins L. 20604, "Type FR Repulsion-Start Induction Motors"; L. 20605, "Type FK Direct-Current Motors"; L. 20606, "Type FS Polyphase Squirrel-Cage Motors. — Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PLASTICS—Booklet, 48 pages, "Bakelite Molded." — Bakelite Corp., River Road, Bound Brook, N. J.

PUMP—Catalog No. 7464, "The Cameron Motorpump—for General Service Everywhere."—Ingersoll-Rand Co., 11 Broadway, New York.

PUMPS—Bulletin W-322-S1, "Worthington Monobloc Centrifugal Pumps, Two Stage, Types G, GA, GB."—Worthington Pump and Machinery Corp., Harrison, N. J.

PUMPS — Bulletin D-423-S11A, "Worthington Power Pumps, Vertical Triplex Single-Acting Type, Equipped with Worthington Multi-V-Drive." — Worthington Pump & Machinery Co., Harrison, N. J.

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PUMPS — Bulletin 152, "Morris Double Suction Horizontally Split Centrifugal Pumps,"—Morris Machine Works, Baldwinsville, N. Y.

PUMPS — Bulletin No. 2078, "Modern Boiler-Feed Pumps for Pressures up to 600 Pounds." — Ingersoll-Rand Co., 11 Broadway, New York.

REFRIGERATION — Bulletin No. 2083, "Water Vapor Refrigeration."—Ingersoll-Rand Co., 11 Broadway, N. Y.

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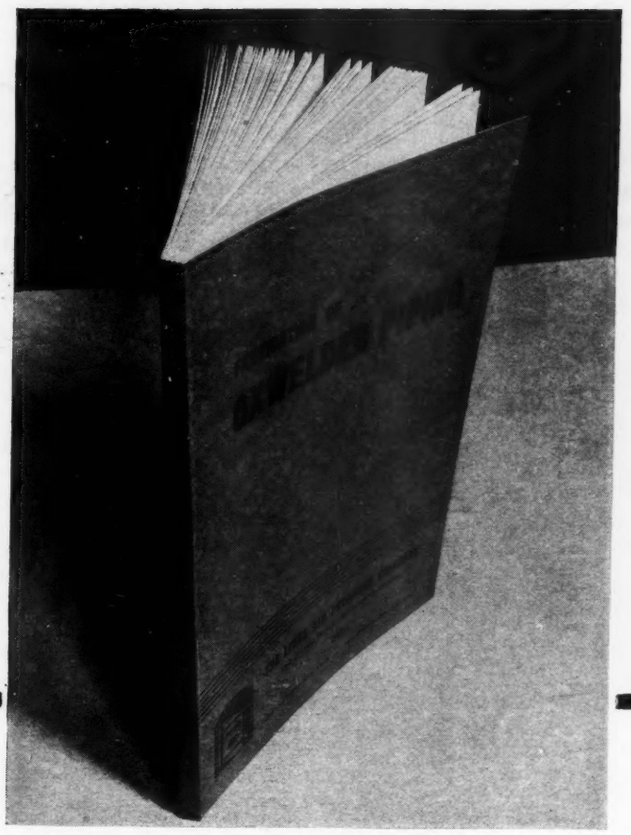

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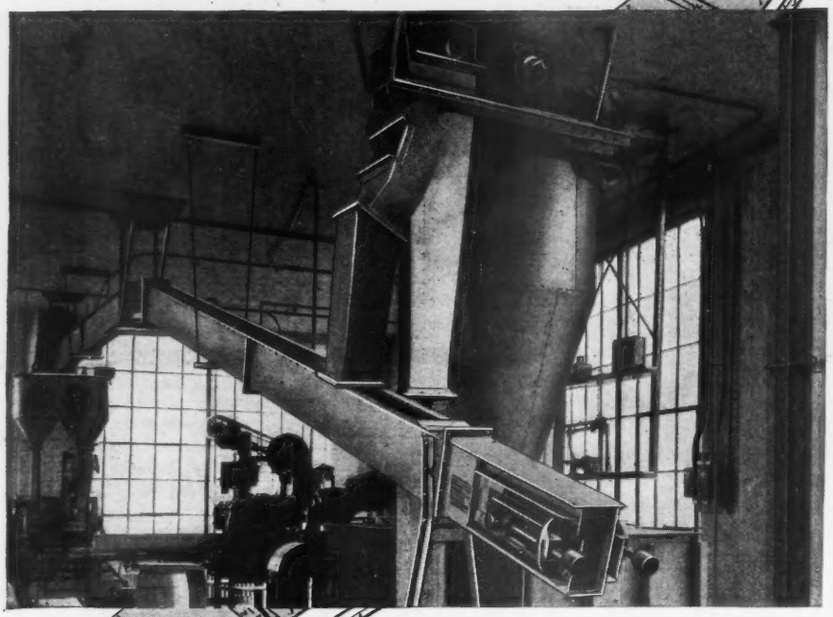

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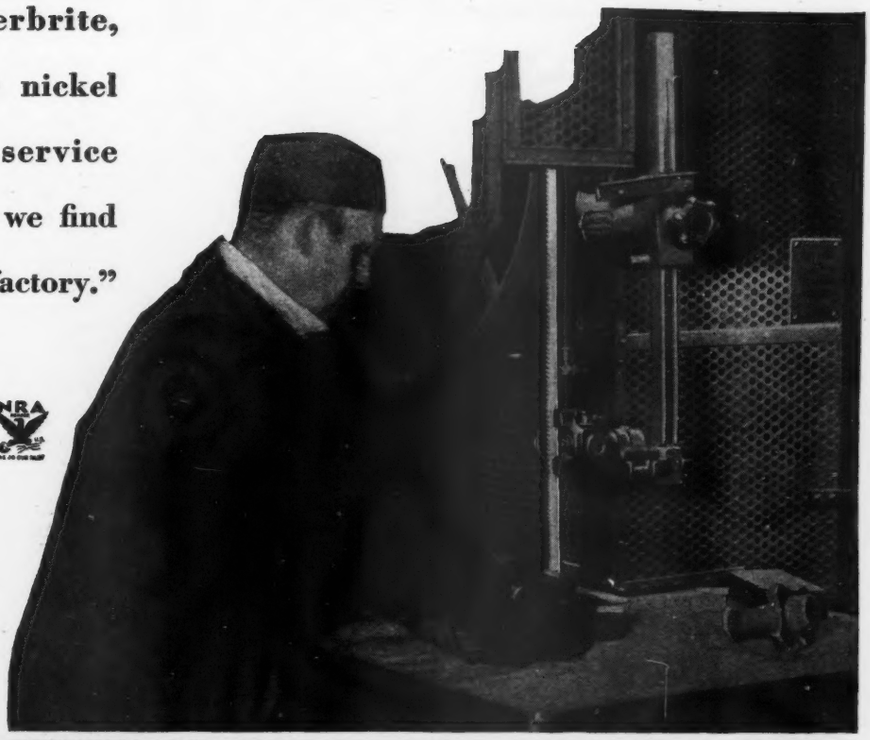

Photograph taken at plant of American Manganese Bronze Company, Philadelphia. Thompson Band Saw Machine, 29½" diameter, 28 R. P. M., operating Disston Band, 15' 7" long, ⅝" wide, 20 gauge, 10 teeth per inch. Cutting risers from castings of Everbrite, Monel Metal and other nickel alloys. Statement on results, by C. H. Williams, Manager, quoted above.

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Evans Clark, J. Frederic Dewhurst, Alfred L. Bernheim, Margaret Grant Schneider. D. Appleton-Century Co., Inc., 11 West 42nd St., New York. 209 pages. $2.

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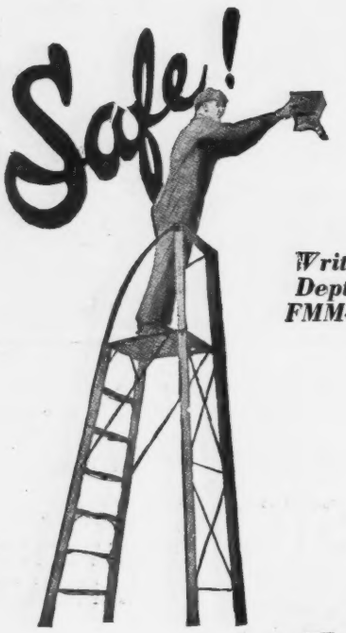


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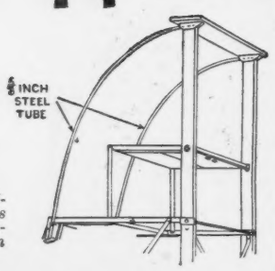


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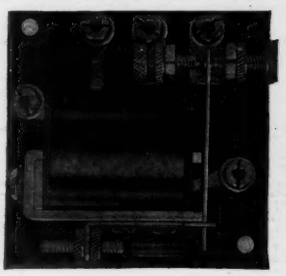

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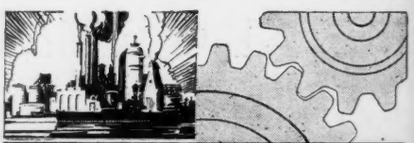

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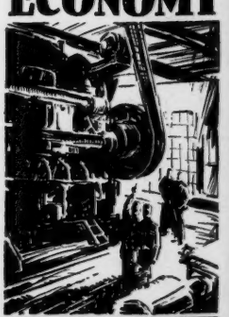

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